

ENSV Inspection Transmittal Summary Report

Media: AIR	Inspection Type: Test Observation	Inspection Date: 07/24/2013	Preliminary SNC Findings NOV / NOPV / NOPF: N/A
Inspector: SCOTT POSTMA		Transmittal Date:	
Facility Name: University Of Iowa			
Address: Coralville IA 52241	ID Number:	Activity Number:	MM Participating Programs REC'D AUG 28 2013 APCO
Federal Activity:	Federal Facility: No	Potential EJ: N/A	
SBREFA Provided: Yes	Security Handout Provided: Yes	MM Screening Completed: N/A	EMS ISO 14001: No
Compliance Officer:			
Selection Criteria 1:	Selection Criteria 2:	ACS Code	

Inspection Findings:

Target Quality:

Compliance test on a wood chip powered unit.



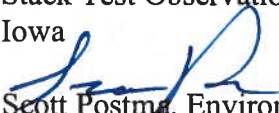
**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 7**

Science and Technology Center
300 Minnesota Avenue
Kansas City, Kansas 66101

AUG 26 2013

MEMORANDUM

SUBJECT: Stack Test Observation at University of Iowa's Oakdale facility in Coralville, Iowa

FROM:  Scott Postma, Environmental Engineer
ENSV/EFCB

TO: Lisa Hanlon, Environmental Scientist
AWMD/APCO

At the request of the Air Permitting and Compliance Branch (APCO), I conducted a stack test observation at the University of Iowa's Oakdale power plant (Oakdale) located in Coralville, Iowa. Specifically, stack emission testing was conducted on the exhaust stack of boiler #5 (Emission Unit EU-239-BLR-5). Oakdale attempted to conduct testing on March 26, 2013, and on May 1, 2013, but due to difficulty achieving operational load, these tests were not completed. Oakdale rescheduled and completed the tests on July 23 and 24, 2013. I was in attendance for each of the three field testing activities.

Oakdale is subject to Title 40, Part 63, Subpart DDDDD, National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters. The Oakdale boiler was built in 2010 by the Hurst company (Attachment 1). The boiler (Emission Unit EU-239-BLR-5) is rated at 27.5 mm Btu per hour and can be fired on either natural gas or biomass. The primary fuel for this boiler is wood chips. Oakdale operates the boiler under its March 9, 2013, Iowa Department of Natural Resources Air Quality Construction Permit (Attachment 2). Oakdale electronically mailed the attached proposed test plan to EPA on February 8, 2013 (Attachment 3). The test notification was submitted to EPA on February 8, 2013 (Attachment 4). Electronic mail and attachments associated with this test are included in Attachment 5.

Oakdale is required to conduct performance testing for sample point location, stack gas volumetric flowrate, oxygen or carbon dioxide, moisture, particulate matter (PM), oxides of nitrogen, carbon monoxide, hydrogen chloride, mercury, and condensable particulate matter

(CPM). The specific requirements are in Oakdale's Air Quality Construction Permit. Testing employed EPA reference methods 1, 2, 3A, 4, 5, 7E, 10, 26, 30B and 202 to determine the above mentioned emissions, respectively. The company performing the stack tests was Mostardi Platt Associates, Inc. (Mostardi Platt). Mostardi Platt used straight non-dilution extraction to obtain the samples.

March 26, 2013, Stack Test Activities

I arrived at the Oakdale plant the morning of Tuesday, March 26, 2013, to observe the tests. Mark Maxwell and Steve Kottenstette, the Environmental Representative and Operations Director for Oakdale, greeted me upon my arrival at the facility. I was escorted to the Oakdale facility offices. I presented my credentials to Mr. Maxwell. We discussed the facility's environmental and safety aspects, the purpose for my visit and the observation procedures I wished to follow. Mr. Maxwell told me that Mostardi Platt's stack testers were on-site and setting up for the tests. He said that the start of testing was slightly delayed. Mr. Maxwell said that Oakdale would have an escort with me during my visit. Mr. Maxwell escorted me for the majority of my visit.

Mr. Maxwell escorted me to the second floor of the boiler room where the testers were setup to perform the tests. Mostardi Platt was set up for methods 5, 202 and 26 testing in the ductwork near the main stack. The test ports were located on the rectangular duct upstream of the stack. I performed preliminary measurements of the test location's representativeness to see if they met the method 1 criteria. The duct met the minimum method 1 specifications.

Mostardi Platt's stack testing trailer was located in the parking lot outside the main Building at the Oakdale facility. I met with Jim Robertson, Rich Sollars, Brandon Schuler, and Abe Dickinson with Mostardi Platt. We discussed the stack testing procedures. I observed the performance of preliminary stack testing activities. I was escorted to the control room at the main office building for various testing related discussions. Additionally, I was given a tour of the facility.

The boiler's nominal capacity is 20,000 to 25,000 pounds of steam per hour (lbs/hr). On March 26, 2013, the boiler was not able to achieve the minimum capacity needed for testing purposes. Mr. Maxwell said that due to the damp fuel supplied earlier in the morning, they were not able to get the boiler to operate above 13,000 lbs/h. Mr. Kottenstette and Mr. Maxwell were not able to achieve a representative minimum steam load in the boiler for testing. Mr. Kottenstette eventually decided to postpone the testing until a representative operational load could be achieved.

The primary fuel for this boiler is wood chips. The General Provisions for Subpart DDDDD requires that the boiler operates at, or near, maximum capacity during the test. Mr. Maxwell told me that the boiler can easily attain 90% capacity (18,000 pounds per hour) while burning mostly dry wood chips. Mr. Maxwell said that the wood chips that were received earlier in the morning had a substantial amount of moisture.

I observed that the wood chips delivered to the Oakdale facility had substantial water content. I observed several large clumps of frozen wood chips. The large chunks would not feed through the fuel loadout screen into the fuel feeding bunker. The wood chips that did feed into the hopper looked significantly wet. Oakdale representatives said that the test would be delayed until a representative fuel could be obtained. I asked the Oakdale representative to notify me when they determined a replacement test date. I also asked that they confirm with the fuel supplier that they get a representative fuel for the retest date. The Oakdale representatives agreed to notify me of the retesting date and to confirm that they will get a representative fuel. Mr. Kottenstette and Mr. Maxwell said that they would talk with the fuel supplier to assure that they receive a representative fuel for the retest. I left the facility in the afternoon of March 26, 2013.

May 1st and 2nd, 2013, Stack Test Activities

Mr. Maxwell notified me in mid April that they had scheduled a test date for May 1, 2013. I arrived at the Oakdale facility the morning of May 1, 2013. I met Mr. Kottenstette and Mr. Maxwell and we discussed the plan for testing. Mr. Kottenstette told me that they are having problems achieving a high load because the wood delivered that morning was cottonwood. He said the cottonwood has a heat content of 13 million Btu per cord. He said that they normally burn hardwoods that have a heat content of approximately 25 million Btu per cord. Mr. Kottenstette said that they will have to burn through the load before they can get representative wood into the fuel bunker. Testing was delayed for one day.

On Wednesday, May 2, 2013, I returned to the Oakdale facility and I met Mr. Kottenstette and Mr. Maxwell. We discussed the plan for testing. Mr. Kottenstette told me that they were working on their TriMer air pollution control device (APCD). The TriMer APCD is designed to reduce multiple pollutants including PM, NO_x, SO₂, HCl, Hg, and dioxins. The TriMer collects PM on ceramic filters. Urea is injected into the APCD for NO_x emissions reduction. The ceramic filters acts as catalysts to convert NO_x into N₂ gas in the presence of urea. The filter surface has nanobits of selective catalyst reduction (SCR) catalyst on the surface of the filters. The urea helps to reduce the oxidation state of the NO_x.

Mr. Kottenstette told me that their APCD was not working properly and that they would need some time to stabilize its operation before testing could begin. Testing was postponed for several hours. At approximately noon, Oakdale representatives told me that they had cancelled the tests due to the APCD problem. They said that they needed to get a representative from TriMer to correct the APCD problem. I left the Oakdale facility at approximately noon on May 2, 2013.

July 23rd and 24th, 2013, Stack Test Activities

Mark Maxwell notified me by electronic mail on June 21, 2013, that the boiler test was scheduled for July 22, 2013. Mr. Maxwell said that they had corrected the fuel moisture and APCD issues. Mr. Maxwell phoned me the morning of Monday July 22, 2013, to report that they were not able to get the boiler to run higher than 75% load. Mr. Maxwell said that the test

was still scheduled, but at a reduced load. Mr. Maxwell said that they were only able to achieve a load of 15,000 pounds of steam per hour (15 Klb/hr). The boiler is reported to have a nominal capacity of 20,000 lb/hr.

Mr. Maxwell called me on July 22, 2013, and said that he was not going to attend the testing due to a medical issue. He said that Mr. Kottenstette would also not be in attendance. Mr. Maxwell said that Mathias Miller and Joe Schwarthoff would be present representing Oakdale.

I arrived at the Oakdale facility at 7:30 a.m. on July 23, 2013. Mostardi Platt was setting up test equipment and running preliminary checks. Mostardi-Platt was setup to sample for oxygen, carbon dioxide, moisture, PM, HCl, and CPM using methods 1, 2, 3A, 4, 5, 26, and 202, respectively. Mr. Miller said that the APCD was not operating optimally. The urea injection rate needed adjustment to attain the lowest NOx emissions. At approximately 9 a.m., Mostardi Platt representative Dan Tuider told me that there was moisture in the O2/CO2 sampling line. It took about 30 minutes to clean and dry the line.

At 11 a.m. Joe Schwartzoff notified me that the highest load the boiler able to achieve was 11,000 to 12,000 lbs/hr. Mr. Schwartzoff said that the Boiler #5 is rated, in their configuration of equipment, to have an achievable capacity up to 22,000 lbs/hour. He said that it was possible that the canisters/cylinders (e.g. PM filtering components) in the APCD may be "coated" with PM and creosote. The PM may be restricting the effluent flow through the APCD causing an increased load on the downstream induced draft (ID) fan. The boiler is designed to maintain a negative pressure. If the forced draft (FD) fan's capacity is increased, the boiler's pressure can become positive. Under the positive pressure scenario, hot caustic gases can leak into the building air from the gas handling equipment. Therefore, the boiler's capacity is limited by the ID fan load.

Run #1 commenced at 12:05 p.m. on July 23, 2013. Mostardi Platt personnel sampled for HCl, PM, CPM, NOx, O2, and CO2. Run #1 method 202 sampled for 2.5 hours.

Mostardi-Platt also conducted sampling using method 26 and completed three 1-hour runs. Run #1, Run #2, and Run #3 commenced at 12:05, 1:35, and 2:55 p.m., respectively. During Run #1 on method 26, I noticed that the operator was not monitoring the sample line temperature. The temperature is required to be monitored every 5 minutes in Sections 8.1.5.1 and 8.1.3 of method 26. I told Abe Dickenson about this requirement. Mr. Dickenson said he was not aware of the requirement but said he would start to monitor the temperature every 5 minutes.

I observed that no sodium thiosulfate was added to the method 26 impinger solutions. Method 26 requires that it be added to stabilize the Cl⁻ ions in the solutions in Section 8.2.2. The results may have a low bias since sodium thiosulfate was not added to the solution.

Run #2 of method 5/202 commenced at 3:30 p.m. on July 23, 2013. The boiler experienced an upset condition at 3:35 causing effluent to leak into the boiler room. The ID fan turned off. The run was stopped during the upset condition. The run recommenced

approximately 20 minutes later after the boiler was operating normally. Run #2 was completed at 7:54 p.m. I left the Oakdale facility during Run #2.

Run #3 of method 5 and 202 commenced at 9 p.m. on July 23, 2013. Run #3 was completed at midnight. I was not in attendance for Run #3.

The Oakdale facility monitors numerous parameters (e.g. temperature, etc.) to help indicate the characteristic of combustion. Attachment 6 contains the parameters monitored during the performance test.

July 24th, 2013, Stack Test Activities

I arrived at the Oakdale facility the morning of July 24, 2013. I observed Oakdale's continuous emissions monitoring systems (CEMS) on the main stack. The effectiveness and relative operation of the control equipment is measured by the CEMS. Oakdale has O₂, CO₂, CO, SO₂, and volumetric flow CEMS.

Methods 1, 2, 3A, 7E, 10, and 30B were conducted on July 24, 2013. The first run commenced at approximately 9 a.m. on July 24, 2013. I observed the procedures utilized by Mostardi Platt on the stack during the first run. I observed that the boiler operated at stable conditions for Run #1. The control equipment appeared stable.

Run #2 commenced at about noon on July 24, 2013. Run #3 commenced at approximately 3 p.m. on July 24, 2013. No major problems were observed on July 24, 2013.

I observed several calibration error tests. No adjustments were conducted on the instruments. I observed a post test drift test. The drift was within the required specification. I completed my Method 7E and 6C Checklist during Run #2, Attachment 7.

I observed the method 3A O₂ and CO₂ sample collection and analysis. No major problems were observed with the sample collection.

During testing, I performed a check of the isokinetic sampling procedures for moisture and PM test equipment and procedures, respectively. The stack effluent was not saturated with water. I did not observe significant problems with the equipment and testing procedures.

I conducted several preliminary field calculations from the instantaneous measurements and stack conditions. The results indicated that the isokinetics, sample points, sampling rates, and volumetric flow rate were being correctly calculated by the testing company.

I conducted checks of the sampling lines, nozzles, and probes. I observed numerous dimensions and aspects of the equipment. I did not observe aspects outside the allowable tolerances. All of the other aspects reviewed met the minimum design criteria. I observed the operational parameters during the period of the stack tests. The operational levels will be included in the final test report. All of the reviewed documents, reported weights, and

preparation appeared to be within the specifications.

Prior to leaving the Oakdale facility, I requested copies of the stack test raw data. I received some of the data by the time I left the facility. Attachment 6 contains the raw test data sheets.

An exit meeting was conducted prior to leaving Oakdale. A Confidentiality Notice and Receipt for Documents and Samples were provided to the facility representative. None of the information was claimed as confidential (Attachment 8 and Attachment 9). I provided copies of the Security Awareness handout and U.S. EPA Small Business Resources Regulatory Enforcement Fairness Act (SBREFA) brochure to the facility representative.

Attachments:

1. Boiler Specifications, 27 pages.
2. Air Quality Construction Permit, 11 pages.
3. Proposed Test Plan, January 30, 2013, 36 pages.
4. Test Notification, 1 page.
5. Correspondences and Attachments, 7 pages.
6. Raw Data Sheets and Operating Data, 19 pages.
7. Methods 7E and 6C Checklist, 6 pages.
8. Confidentiality Notice, 1 page.
9. Receipt for Samples and Documents, 1 page.

REGION 7 - AIR - EPA INSPECTION CONCLUSION DATA SHEET (ICDS) 2006 Form

Inspectors Name: Scott Postma

Phone No.: (913) 551-7048

1. *Compliance Activity Type: Compliance Inspection

2. *Compliance Monitoring Activity Name: University of Iowa, Oakdale Campus

* Region 7 EPA ID Number (AFS): 2090008

3. *Facility Name: University of Iowa, Oakdale Campus Plant

4. *Street Address: 2320 Crosspark Road, Coreville, Iowa 52241

*City, State, Zip: Coreville, Iowa 52241

5. - 9. ** Date of Inspection: Begin: 3/26/2013 End: 6/ /2013 (mm/dd/yyyy)

10. *Federal Statutes: CAA - Stationary

11. *Sections: Circle the regulatory citation(s) that apply to the inspection conducted

CAA -110 - CAASIP - State Implementation Plan (SIP)

CAA -111 - CAANSPS - New Source Performance Standards (NSPS)

CAA -112 - CAAMACT - NESHAP/MACT

CAA -118 - COPFFF - Control of Pollution from Federal Facilities

CAA -129 - CAASWFC - Solid Waste Fuel Combustion

CAA -183(E)(A) - CAABAC - Best Available Controls

CAA -183(E)(B) - CAACCP - Consumer/Commercial Products

CAA - 608 - CAASO -Stratospheric Ozone Protection

CAA - 609 - CAASO -Stratospheric Ozone Protection

CAA - 610 - CAASO -Stratospheric Ozone Protection

CAA - 611 - CAASO -Stratospheric Ozone Protection

CAA - PARTC - CAAPSD - PSD

CAA - PARTD - CAANSP - Nonattainment/SIP Provisions

CAA - TITLE4 - CAAAR - Acid Rain

CAA - TITLE5 - CAAOP - Operating Permits

CAA -183(F) - CAATVS - Tank Vessel Standards

12. Citations: circle all citations of 40 CFR that were inspected: 59, 60, 61, 62, 63, 64, 70, 72, 75, 82, Other

13. * Programs: No entry needed. This data element is automatically populated by the ICIS data system

14. **SIC (4-digit) 4911 or NAICS Code (5-digit): 221112 (Enter one or more)

15. Do not complete

16. *Compliance Monitoring Action Reason: (Circle one of the following)

Agency Priority

Citizen Complaint/Tip

Core Program

Selected Monitoring Action

Random Evaluation or Inspection

17. *Compliance Monitoring Agency Type: EPA

18. - 20. Does not apply

21. Compliance Monitoring Action Outcome: Check one (if known at the time of the activity):

Administrative_____

Immediately corrected_____

Judicial_____

No compliance monitoring (access denied)_____

No compliance monitoring (facility shutdown)_____

Not immediately corrected_____

Notice of Determination_____

Under review XX

Withdrawn_____

22. **MOA Priorities:** (Circle only one (if it applies) from the following)
- | | |
|--|--|
| CAA Air Toxics & NSR/PSD - Coal-Fired Power Plant (SIC 4911) | Petroleum Refining - Benzene Waste (BENZW) |
| CAA NSR/PSD | Petroleum Refining - LDAR (LDAR) |
| CAA Air Toxics | Petroleum Refining - Refinery Fuel Gas (REFFG) |
23. **Regional Priorities:** (Circle only one (if it applies) from the following)
- | | |
|--|------------------------|
| EPCRA & CAA Section 112(r) Accident History by Facility | Agriculture |
| EPCRA & CAA Section 112(r) Accident History by Industry Sector | Endangered ECO Systems |
| EPCRA & CAA Section 112(r) St. Louis Project | Sensitive Populations |
| Lead Based Paint | |
24. ****Did you observe deficiencies (potential violations) during the on-site inspection?** ☒ Yes ☐ No
N/A cannot be a response.
25. ****If you observed deficiencies, did you communicate them to facility during the inspection?** ☒ Yes ☐ No
26. ****Deficiencies Observed:**
Check one or more of the following:
- ☐ Potential violation of a compliance schedule in an enforceable order
 - ☐ Potential failure to maintain a record or failure to disclose a document
 - ☒ Potential failure to maintain, inspect or repair equipment including meters, sensors, and recording equipment
 - ☐ Potential failure to complete or submit a notification, report, certification, or manifest
 - ☐ Potential failure to obtain a permit, product approval, or certification
 - ☐ Potential failure to follow a required sampling or monitoring procedure or laboratory procedure
 - ☐ Potential failure to follow or develop a required management practice or procedure
 - ☐ Potential failure to identify and manage a regulated waste or pollutant in any media
 - ☐ Potential failure to report regulated events such as spills, accidents, etc.
 - ☐ Potential incorrect use of a material (e.g., pesticide, waste, product, etc.) or use of improper or unapproved material
 - ☐ Potential failure to follow a permit condition (s)
 - ☐ Potential excess emission in violation of a regulation
27. ****Did you observe or see the facility take any actions during the inspection to address the deficiencies communicated to the facility?** ☒ Yes ☐ No If YES, check only the action(s) actually observed/seen or write in a short description of the action in the "optional" section. (Check all that apply)
- Action(s) taken**
- ☐ Complete(d) a Notification or Report
 - ☒ Correct(ed) Monitoring Deficiencies
 - ☐ Correct(ed) Record Keeping Deficiencies
 - ☐ Implemented New or Improved Management Practices or Procedures
 - ☐ Improved Pollutant Identification (e.g., Labeling, Manifesting, Storage, etc.)
 - ☐ Reduced Pollution (e.g., Use Reduction, Industrial Process Change, Emissions or Discharge Change, etc.)
 - ☐ Request(ed) a Permit Application or Applied for a Permit
 - ☐ Verify (ied) Compliance with Previously Issued Enforcement Action - Part or All Conditions
28. **Did you provide general compliance assistance in accordance with the policy on the Role of the EPA Inspector in Providing Compliance Assistance During Inspections?** ☒ Yes ☐ No
29. **Did you provide site-specific compliance assistance in accordance with the policy on the Role of the EPA Inspector in Providing Compliance Assistance During Inspections?** ☒ Yes ☐ No
Note: This form does not require EPA inspectors to provide compliance assistance.
- Optional Information:** Describe actions taken by the facility or assistance provided to the facility (Print neatly)
-
-
-

For Data Entry Staff Use Only:

30. Date and initials of person entering data into ICIS (mm/dd/yyyy): _____

ATTACHMENT 1



STATE OF IOWA

TERRY E. BRANSTAD, GOVERNOR
KIM REYNOLDS, LT. GOVERNOR

DEPARTMENT OF NATURAL RESOURCES
ROGER L. LANDE, DIRECTOR

March 9, 2012

CERTIFIED MAIL

Mark Maxwell
Environmental Engineer
330 USB
University of Iowa
Iowa City, Iowa 52242

Re: Plant Number: 52-01-005
Project Number: 12-088
Permit Number: 78-A-023-S7

Dear Mr. Maxwell:

This letter transmits the attached construction permit for the above referenced project consisting of the following air contaminant source described in the application received March 1, 2012. It is the Iowa Department of Natural Resources Air Quality Bureau's (Department's) understanding that the letter reflects accurate and complete information.

Emission Point	Description	Control	Testing Required	IDNR Permit Number	Action
EP 239-1	OD Boilers, 2, 3, and 4, Hurst Boiler, and AgBiopower Gasifier	SCR, filter for Hurst Boilers	Yes	78-A-023-S7	Issue

Your attention is directed toward the specified Permit Conditions contained within the permits; especially Sections 10, 12, 13, 14, and 15. Based on the information submitted in your letter, the Department has made the following determinations:

1. The natural gas boilers (OD's #2, 3, and 4) are not currently subject to a New Source Performance Standards (NSPS) at this time, as they were constructed

prior to the applicability date of June 9, 1989 and not subsequently modified as to increase emissions.

2. The Hurst Boiler is subject to the NSPS, Subpart Dc – Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units.
3. This facility is of the type subject to 40 CFR 63 Subpart DDDDD – National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers and Process Heaters.
4. This facility is a major source with regard to Title V Operating Permit regulations.
5. This facility is a major source with regard to PSD regulations.
6. Compliance testing is required at this time.

The above is a brief list of the determinations made and limits being required. Please review the construction permits to understand the requirements to remain in compliance. Also attached is a copy of the "Air Quality Equipment Notification Form" to assist you in "Notification, Reporting and Recordkeeping" (Section 8). In the future, a status report of the construction permit application(s) submitted to the Department is available at the State Permitting and Air Reporting System (SPARS) website located at the following address: <http://aq48.dnraq.state.ia.us:8080/wspars/default.htm>. When requesting future modifications to the permit, use the permit number and your plant number for identification. Should you have any questions about these issued permits, please contact Julie Ingoli at (515) 242-5131. For any other questions, please call 1-877 AIR IOWA.

Sincerely,



Christopher A. Rolling, P.E.
Senior Environmental Engineer
Air Construction Permitting
Air Quality Bureau, IDNR

cc: DNR Field Office 6 w/ enclosures
DNR File 52-01-005 w/ enclosures

Enclosures – Air Construction Permits: 78-A-023-S7

Iowa Department of Natural Resources

Air Quality Construction Permit

Permit Holder

Firm: The University of Iowa – Oakdale Campus

Contact:

Mark Maxwell
Environmental Engineer

(319) 335-6185

330 USB, University of Iowa
Iowa City, Iowa 52242

Responsible Party:

Douglas K. True
Senior VP F&O, Treasurer

Permitted Equipment

Emission Unit(s): OD#2 Boiler – 32.1 MMBtu/hr – Natural Gas
OD#3 Boiler – 32.1 MMBtu/hr – Natural Gas
OD#4 Boiler – 20.3 MMBtu/hr – Natural Gas
EU-239-BLR-5 – Hurst Boiler, 27.5 MMBtu/hr – Gas/Biomass
EU-239-GSFR-1 – AgBiopower Gasifier, 2.5 MMBtu/hr (thru Hurst)

Control Equipment: Ultra Temp Hot Gas Filtration (SCR, filter) for Hurst Boiler
OD#2, OD#3 and OD#4 Boilers – no control

Emission Point: BP 239-1

Equipment Location: Oakdale Campus
Coralville, Iowa 52319

Plant Number: 52-01-005

Permit No.	Proj. No.	Description	Date	Testing
78-A-023		Original Permit	2/7/78	No
78-A-023-S1	96-379	Coal to Natural gas/oil for OD#2, 3 and 4	8/28/96	No
78-A-023-S2	98-064	Add Boiler 1, Coal to Gas/oil	3/16/98	No
78-A-023-S3	01-175	Correct Air Flow	5/24/01	No
78-A-023-S4	03-685	Limit Fuel to Natural Gas Only	11/18/03	No
78-A-023-S5	10-069	Remove OD#1 & Add Hurst Boiler/Gasifier	6/22/10	Yes
78-A-023-S6	12-015	Reduce PM/PM10 Limit for Hurst Boiler	1/18/12	Yes
78-A-023-S7	12-088	Permit Corrections for Hurst Boiler	3/9/12	Yes

Christopher A. Holing, P.E.

Under the Direction of the Director of
the Department of Natural Resources

CPFP | 5201005 | 03092012 | 12088 | 78A023S7

PERMIT CONDITIONS

The permit holder, owner and operator of the facility shall assure that the installation, operation, and maintenance of this equipment is in compliance with all of the conditions of this permit and all other applicable requirements. This permit and its provisions are subject to the appeal rights set forth in Iowa Administrative Code (IAC), rule 561—7.5.

1. Departmental Review

This permit is issued based on information submitted by the applicant. Any misinformation, false statements or misrepresentations by the applicant shall cause this permit to be void. In addition, the applicant may be subject to criminal penalties according to Iowa Code Section 455B.146A.

This permit is issued under the authority of 567 Iowa Administrative Code (IAC) 22.3. The proposed equipment has been evaluated for conformance with Iowa Code Chapter 455B; 567 IAC Chapters 20 – 34; and 40 CFR Parts 51, 52, 60, 61, and 63 and has the potential to comply.

No review has been undertaken on the engineering aspects of the equipment or control equipment other than the potential of that equipment for reducing air contaminant emissions. The DNR assumes no liability, directly or indirectly, for any loss due to damage to persons or property caused by, resulting from, or arising out of the design, installation, maintenance or operation of the proposed equipment.

2. Transferability

As limited by 567 IAC 22.3(3)"F", this permit is not transferable from one location to another or from one piece of equipment to another, unless the equipment is portable. When portable equipment for which a permit has been issued is to be transferred from one location to another, the DNR shall be notified in writing at least fourteen (14) days prior to transferring to the new location unless the equipment will be located in an area which is classified as nonattainment for the National Ambient Air Quality Standards (NAAQS) or is a maintenance area for the NAAQS in which case notification shall be given thirty (30) days prior to the relocation of equipment¹ (See Permit Condition 8.A.6). The owner will be notified at least ten (10) days prior to the scheduled relocation if the relocation will cause a violation of the (NAAQS). In such case, a supplements permit shall be required prior to the initiation of construction of additional control equipment or equipments modifications needed to meet the standards.

The permit is for the construction and operation of specific emission unit(s), control equipment, and emission point as described in this permit and in the application for this permit. Any owner or operator of the specified emission unit(s), control equipment, or emission point, including any person who becomes an owner or operator subsequent to the date on which this permit is issued, is responsible for compliance with the provisions of this permit. No person shall construct, install, reconstruct or alter this emissions unit, control equipment or emission point without the required revisions to this permit.

¹ A list of nonattainment areas and maintenance areas for the NAAQS can be obtained from the Department.

3. Construction

It is the owner's responsibility to ensure that construction conforms to the final plans and specifications as submitted, and that adequate operation and maintenance is provided to ensure that no condition of air pollution is created.

This permit shall become void if any one of the following conditions occur:

- (1) the construction or modification of the proposed project, as it affects the emission point(s) permitted herein, is not initiated within eighteen (18) months after the permit issuance date; or
- (2) the construction or modification of the proposed project, as it affects the emission point(s) permitted herein, is not completed within thirty-six (36) months after the permit issuance date; or

3. Construction (Continued)

- (3) the construction or modification of the proposed project, as it affects the emission point(s) permitted herein, is not completed within a time period specified elsewhere in this permit.

3.a. Original Permits

The owner or operator shall obtain a new permit if any changes are made to the final plans and specifications submitted for the proposed project.

3.b. Modified or Supplemental Permits

This permit supersedes any and all previous permits issued for the emission point(s) or emission unit(s) permitted herein.

However, the permittee may continue to act under the provisions of the previous permit for the emission point(s) or emission unit(s) until one of the following conditions occurs:

- (1) The proposed project authorized by this permit is completed as it affects the emission point(s) permitted herein; or
- (2) The permit becomes void.

The owner or operator shall obtain a new permit if:

- (1) Any changes are made to the final plans and specifications submitted for the proposed project; or
- (2) This permit becomes void.

4. Credible Evidence

As stated in 567 IAC 21.5 and also in 40 CFR Part 60.11(g), where applicable, any credible evidence may be used for the purpose of establishing whether a person has violated or is in violation of any provisions specified in this permit or any provisions of 567 IAC Chapters 20 through 34.

5. Owner Responsibility

Issuance of this permit shall not relieve the owner or operator of the responsibility to comply fully with applicable provisions of the State Implementation Plan (SIP), and any other requirements of local, state, and federal law.

The owner or operator of any emission unit or control equipment shall maintain and operate the equipment and control equipment at all times in a manner consistent with good practice for minimizing emissions, as required by paragraph 567 IAC 24.2(1) *"Maintenance and Repair"*.

6. Excess Emissions

Excess emissions during a period of startup, shutdown, or cleaning of control equipment are not a violation of the emission standard if it is accomplished expeditiously and in a manner consistent with good practice for minimizing emissions except when another regulation applicable to the unit or process provides otherwise. Cleaning of control equipment, which does not require the shutdown of process equipment, shall be limited to one six-minute period per one-hour period. An incident of excess emissions other than the above is a violation and may be subject to criminal penalties according to Iowa Code 455B.146A. If excess emissions are occurring, either the control equipment causing the excess shall be repaired in an expeditious manner, or the process generating the emissions shall be shutdown within a reasonable period of time, as specified in 567 IAC 24.1.

An incident of excess emissions shall be orally reported to the appropriate DNR field office within eight (8) hours of, or at the start of, the first working day following the onset of the incident (See section 8.B.1). A written report of an incident of excess emissions shall be submitted as a follow-up to all required oral reports within seven (7) days of the onset of the upset condition.

7. Disposal of Contaminants

The disposal of materials collected by the control equipment shall meet all applicable rules.

8. Notification, Reporting, and Recordkeeping

- A. The owner shall furnish the DNR the following written notifications:
1. The date construction, installation, or alteration is initiated postmarked within thirty (30) days following initiation of construction, installation, or alteration;
 2. The actual date of startup, postmarked within fifteen (15) days following the start of operation;
 3. The date of each compliance test required by Permit Condition 12, at least thirty (30) days before the anticipated compliance test date;
 4. The date of each pretest meeting, at least fifteen (15) days before the proposed meeting date. The owner shall request a proposed test plan protocol questionnaire at least sixty (60) days prior to each compliance test date. The completed questionnaire shall be received by the DNR at least fifteen (15) days before the pretest meeting date;
 5. Transfer of equipment ownership, within 30 days of the occurrence;
 6. Portable equipment relocation:
 - a. at least thirty (30) days before equipment relocation if the equipment will be located in a nonattainment area for the National Ambient Air Quality Standards (NAAQS) or a maintenance area for the NAAQS;
 - b. at least fourteen (14) days before equipment relocation.
- B. The owner shall furnish the DNR with the following reports:
1. Oral excess emissions reports, in accordance with 567 IAC 24.1;
 2. A written compliance demonstration report for each compliance testing event, whether successful or not, postmarked not later than six (6) weeks after the completion of the test period unless other regulations provide for other notification requirements. In that case, the more stringent reporting requirement shall be met;
 3. Operation of this emission unit(s) or control equipment outside of those limits specified in Permit Conditions 10 and 14 and according to the schedule set forth in 567 IAC 24.1.
- C. The owner shall send correspondence regarding this permit to the following address:
- Construction Permit Supervisor
Air Quality Bureau
Iowa Department of Natural Resources
7900 Hickman Road, Suite 1
Windsor Heights, IA 50324
Telephone: (515) 281-8189
Fax: (515) 242-5094
- D. The owner shall send correspondence concerning stack testing to:
- Stack Testing Coordinator
Air Quality Bureau
Iowa Department of Natural Resources
7900 Hickman Road, Suite 1
Windsor Heights, IA 50324
Telephone: (515) 242-6001
Fax: (515) 242-5127

8. Notification, Reporting, and Recordkeeping (Continued)

E. The owner shall send reports and notifications to:

Compliance Unit Supervisor Air Quality Bureau Iowa Department of Natural Resources 7900 Hickman Road, Suite 1 Windsor Heights, IA 50324 Telephone: (515) 281-8448 Fax: (515) 242-5127	IDNR Field Office #6 1023 West Madison Washington, Iowa 52353 Telephone: (319) 653-2135 Fax: (319) 653-2856
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F. All data, records, reports, documentation, construction plans, and calculations required under this permit shall be available at the plant during normal business hours for inspection and copying by federal, state, or local air pollution regulatory agencies and their authorized representatives, for a minimum of two (2) years from the date of recording.

9. Permit Violations

Knowingly committing a violation of this permit may carry a criminal penalty of up to \$10,000 per day fine and 2 years in jail according to Iowa Code Section 455B.146A.

10a. Emission Limits – Natural Gas Only Boilers (OD#2, OD#3 and OD#4)

Pollutant	lb/hr ¹	tons/yr ²	Additional Limits	Reference (567 IAC)
Particulate Matter (PM)	0.76 ⁴	NA	0.6 lb/MMBtu	23.3(2)"b"(3)
PM ₁₀	0.76 ⁴	NA	NA	NA
Opacity	NA	NA	40% ³	23.3(2)"d"
Sulfur Dioxide (SO ₂)	NA	NA	500 ppmv	23.3(3)"e"
Nitrogen Oxides (NO _x)	10.0 ⁴	NA	NA	NA
Volatile Organic Compounds	NA	NA	NA	NA
Carbon Monoxide (CO)	NA	NA	NA	NA
Lead (Pb)	NA	NA	NA	NA
(Single HAP)	NA	NA	NA	NA
(Total HAP)	NA	NA	NA	NA

¹ Standard is expressed as the average of three (3) runs.

² Standard is a 12-month rolling total.

³ An exceedance of the indicator opacity of 10% will require the owner/operator to promptly investigate the emission unit and make corrections to operations or equipment associated with the exceedance. If exceedances continue after the corrections, the DNR may require additional proof to demonstrate compliance (e.g., stack testing).

⁴ Permit limits established during Project No. 03-685 (issued 11/18/2003) when boilers were modified limiting them to Natural Gas Only to Natural Gas thus emissions limits were reduced. Limits reflect AP-42 emission factors Section 1.4 (7/98 Edition).

10b. Emission Limits – Hurst Boiler

Pollutant	lb/hr ¹	tons/yr ²	Additional Limits	Reference (567 IAC)
Particulate Matter (PM)	1.073 ⁴	NA	0.1 gr/dscf	23.3(2)"a"
PM ₁₀	1.073 ⁴	NA	NA	NAAQS
Opacity	NA	NA	40% ³	23.3(2)"d"
Sulfur Dioxide (SO ₂)	NA	30.0 ^{4,5}	NA	NA
Nitrogen Oxides (NO _x)	4.13 ⁴	NA	NA	NAAQS
Volatile Organic Compounds	NA	NA	NA	NA
Carbon Monoxide (CO)	4.13 ⁴	NA	NA	NA
Lead (Pb)	NA	NA	NA	NA
Hydrogen Chloride (HCL)	2.0 ⁶	NA	NA	NA
(Total HAP)	NA	NA	NA	NA

¹ Standard is expressed as the average of three (3) runs.

² Standard is a 12-month rolling total.

³ An exceedance of the indicator opacity of 10% will require the owner/operator to promptly investigate the emission unit and make corrections to operations or equipment associated with the exceedance. If exceedances continue after the corrections, the DNR may require additional proof to demonstrate compliance (e.g., stack testing).

⁴ Set to keep project 10-069 minor for PSD, dispersion modeling passed and accepted by IDNR May 25, 2010.

⁵ Sulfur dioxide emission due to solid fuels only – see Condition 15 for details.

⁶ Set to keep project 10-069 a minor source for 112(g).

11. Emission Point Characteristics

This emission point shall conform to the specifications listed below:

Parameter	Value
Stack Height, (ft, from the ground)	90
Discharge Style	Vertical, unobstructed
Stack Opening, (inches, dia.)	60
Exhaust Temperature (°F)	460
Exhaust Flowrate (scfm)	34,700 scfm OD Boilers 19,724 acfm Hurst Boiler

The temperature and flow rate are intended to be representative and characteristic of the design of the permitted emission point. The Department recognizes that the temperature and flow rate may vary with changes in the process and ambient conditions. If it is determined that any of the emission point design characteristics are different than the values stated above, the owner/operator must notify the Department and obtain a permit amendment, if required.

12. Compliance Demonstration(s) and Performance Testing

Pollutant	Initial	Subsequent	Methodology	Frequency
PM (federal)	No	No	NA	NA
PM (state)	Yes ¹	No	Stack Test	NA
PM ₁₀	No	No	NA	NA
Opacity	Yes ¹	No	Stack Test	NA
SO ₂	Yes ³	Yes ³	Recordkeeping ³	Continuous
NO _x	Yes ¹	No	Stack Test	NA
VOC	No	No	NA	NA
CO	Yes ¹	No	Stack Test	NA
Pb	No	No	NA	NA
HCL	Yes ^{1,2}	No	Stack Test	NA

¹ Hurst boiler only, when combusting solid fuel.

² Test shall be done for the initial combusting of recycled paper sludge and also for corn cobs. The University of Iowa may demonstrate compliance for recycled paper sludge by using the results from the test when combusting corn cobs.

³ When combusting solid fuels in the Hurst boiler, the owner or operator shall calculate and record the amount of sulfur dioxide emitted due to the solid fuels for each fuel combusted using a mass balance.

If an initial compliance demonstration specified above is testing, the owner shall verify compliance with the emission limitations contained in Permit Condition 10 within sixty (60) days after achieving maximum production rate and no later than one hundred eighty (180) days after the initial startup date of the proposed equipment.

If subsequent testing is specified above, the owner shall verify compliance with the emission limitations contained in Permit Condition 10 according to the frequency noted above.

If testing is required, the owner shall use the test method and run time listed in the table below unless another testing methodology is approved by the Department prior to testing.

Pollutant	Test Run Time	Test Method
PM (federal)	1 hour	40 CFR 60, Appendix A, Method 5
PM (state)	1.5 hour	Iowa Compliance Sampling Manual Method 5
PM ₁₀	1 hour	40 CFR 51, Appendix M, 201A with 202
Opacity	1 hour	40 CFR 60, Appendix A, Method 9
SO ₂	1 hour	40 CFR 60, Appendix A, Method 6C
NO _x	1 hour	40 CFR 60, Appendix A, Method 7E
VOC	1 hour	40 CFR 60, Appendix A, Method 25A
CO	1 hour	40 CFR 60, Appendix A, Method 10
Pb	1 hour	40 CFR 60, Appendix A, Method 12
Other		

The unit(s) being sampled should be operated in a normal manner at its maximum continuous output as rated by the equipment manufacturer, or the rate specified by the owner as the maximum production rate at which this unit(s) will be operated. In cases where compliance is to be demonstrated at less than the maximum continuous output as rated by the manufacturer, and it is the owner's intent to limit the capacity to that rating, the owner may submit evidence to the Department that this unit(s) has been physically altered so that capacity cannot be exceeded, or the Department may require additional testing, continuous monitoring, reports of operating levels, or any other information deemed necessary by the Department to determine whether this unit(s) is in compliance.

Each emissions compliance test must be approved by the Department. Unless otherwise specified by the Department, each test shall consist of three (3) separate runs. The arithmetic mean of three (3) acceptable test runs shall apply for compliance, unless otherwise indicated by the Department.

A pretest meeting shall be held at a mutually agreeable site no less than fifteen (15) days prior to the date of each test. Representatives from the Department shall attend this meeting, along with the owner and the testing firm, if any. It shall be the responsibility of the owner to coordinate and schedule the pretest meeting. The owner shall be responsible for the installation and maintenance of test ports. The Department shall reserve the right to impose

additional, different, or more detailed testing requirements.

13. NSPS and NESHAP Applicability

- A. The natural gas boilers (OD#2, OD#3 and OD#4) are not currently subject to a New Source Performance Standard (NSPS) at this time, as they were constructed prior to the applicability date of June 9, 1989 and not subsequently modified as to increase emissions.
 - B. The Hurst Boiler is subject to the NSPS, Subpart Dc – Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units.
 - C. This facility is of the type subject to 40 CFR 63 Subpart DDDDD – National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers and Process Heaters.
-

14. Operating Limits

Operating limits for this emission unit shall be:

- A. OD#2, OD#3 and OD#4 shall be fired by natural gas only. Prior to burning any other fuel in these units, the permittee shall apply for, and obtain, a new construction permit from the Iowa DNR.
 - B. The maximum heat input for OD#2 is 32.1 MMBtu/hr. The maximum heat input for OD#3 is 32.1 MMBtu/hr. The maximum heat input for OD#4 is 20.3 MMBtu/hr. The maximum heat input for the Hurst boiler is 27.5136 MMBtu/hr.
 - C. The gasifier (EU-239-GSFR-1) shall exhaust through the Hurst Boiler, and shall be operated only when the Hurst Boiler is also in operation.
 - D. The Hurst Boiler may operate a maximum of 7,700 hours per twelve month rolling period.
 - E. Approved fuels for the Hurst Boiler include the following: natural gas, landfill gas, syngas from the gasifier, biomass including oat hulls, chipped poplar wood, untreated and unpainted wood chips, wood pellets, corn cobs, corn seed, soybean seeds, cardboard, and recycled paper sludge.
 - F. Approved fuels for the gasifier include the following: oat hulls, chipped poplar wood, untreated and unpainted wood chips, wood pellets, corn cobs, corn seed, soybean seeds, cardboard, car fluff, car arm rest materials, corn stalks/stover and recycled paper sludge.
 - G. The owner or operator shall keep a maintenance plan and records of conducted maintenance for the boiler and associated control equipment, and must, to the extent practicable, maintain and operate the boilers in a manner consistent with good air pollution control practice for minimizing emissions.
-

15. Operating Condition Monitoring

All records as required by this permit shall be kept on-site for a minimum of two (2) years and shall be available for inspection by the DNR. Records shall be legible and maintained in an orderly manner. These records shall show the following:

- A. The owner or operator shall record the hours of operation for the Hurst boiler, and update the twelve month rolling total hours of operation on a monthly basis.
- B. The owner or operator shall keep records of control equipment inspections and maintenance.
- C. The owner or operator shall monitor and record the pressure drop across the control equipment on a weekly basis.

15. Operating Condition Monitoring (Continued)

- D. The owner or operator shall monitor and record the reagent injection rates for the control equipment on a weekly basis.
- E. The owner or operator shall notify the DNR as required in 40 CFR 60.48c(a) for the Hurst Boiler.
- F. The owner or operator shall record the amount of each fuel combusted in the Hurst boiler on each operating day. If syngas from the gasifier is combusted, the owner or operator shall also note the amounts and type of feedstock used in the gasifier.
- G. The owner or operator shall keep records demonstrating the sulfur percentage of each solid fuel combusted in the Hurst boiler on an as-fired basis.
- H. Sulfur dioxide emissions shall be updated per twelve month rolling total (sum of emissions from all fuels) on a monthly basis.

16. Continuous Emission Monitoring

Continuous emission monitoring is not required by this permit at this time.

17. Description of Terms and Acronyms

acfm	Actual cubic feet per minute
Applicant	The owner, company official or authorized agent
CFR	Code of Federal Regulations
Department	Iowa Department of Natural Resources
DNR	Iowa Department of Natural Resources
gr/dscf	Grains per dry standard cubic foot
HAP	Hazardous Air Pollutant(s)
IAC	Iowa Administrative Code
MMBtu	One million British thermal units
NA	Not Applicable
NAAQS	National Ambient Air Quality Standards
NO _x	Nitrogen Oxides
Owner	The owner or authorized representative
Permit	This document including permit conditions and all submitted application materials
PM ₁₀	Particulate Matter equal to or less than 10 microns in aerodynamic diameter
scfm	Standard cubic feet per minute
SIP	State Implementation Plan
SO ₂	Sulfur Dioxide
VOC	Volatile Organic Compound

END OF PERMIT CONDITIONS

ATTACHMENT 2

Gaseous and Particulate Emissions Test Protocol

The University of Iowa

Oakdale Renewable Energy Plant
Hurst Boiler Exhaust Duct
Coralville, Iowa

Plant No. 52-01-005
Permit No. 78-A-023-S5

Protocol No. M131103

January 30, 2013





Gaseous and Particulate Emissions Test Protocol

The University of Iowa

Oakdale Renewable Energy plant
Hurst Boiler Exhaust Duct
Coralville, Iowa

Protocol Submittal Date
January 30, 2013

Submitted By

A handwritten signature in black ink, appearing to read "Chris Jensen".

Chris Jensen
(630) 993-2100, Phone
cjensen@mp-mail.com, Email

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Mostardi Platt

PROTOCOL NO. M131103

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1.0 INTRODUCTION

MOSTARDI PLATT will be performing a gaseous and particulate emission test program at the Oakdale Renewable Energy Plant in Coralville, Iowa on the Hurst Boiler Exhaust Duct.

The test location and test parameters are summarized below.

Test Location	Test Parameters
Exhaust Duct	Nitrogen Oxides (NO _x), Carbon Monoxide (CO), Total Particulate Matter (TPM), Mercury (Hg), and Hydrochloric Acid (HCl)

Emission limits for the above listed parameters are as follows.

Location	Pollutant	MACT Emission Limit	Permitted Emission Limit
Hurst Boiler Exhaust Duct	TPM	0.029 lb/MMBtu	2.20 lb/hr and 0.1 gr/dscf
	HCl	0.022 lb/MMBtu	-
	Hg	0.86 TBtu	-
	NO _x	-	4.13 lb/hr
	CO	590 ppm @ 3% O ₂	4.13 lb/hr

The identification of individuals associated with the test program is summarized below.

Location	Address	Contact
Test Facility	The University of Iowa Oakdale Renewable Energy Plant Oakdale Campus Coralville, Iowa 52319	Mark Maxwell Environmental Engineer (319) 335-6185 (phone) mark-maxwell@uiowa.edu
Testing Company Representative	Mostardi Platt 888 Industrial Road Elmhurst, Illinois 60126	Chris Jensen Senior Project Manager (630) 993-2100 (phone) cjensen@mp-mail.com

2.0 PROCESS DESCRIPTION

The Hurst Biomass Boiler located at the University of Iowa Oakdale Power Plant, is a ~~2.5~~ ~~MMBtu/Hr~~ boiler capable of burning biomass, pipeline natural gas, or syngas. While the construction permit allows the use of several different biomass fuels, we are currently limiting the solid fuel to wood chips only. A 2.5 MMBtu/Hr gasifier attached to the boiler will occasionally be operated to supply syngas to the unit, and natural gas will be used for boiler startup. Flue gas from the boiler enters a duct that is shared with three other natural gas boilers, and passes through the plant to a 90' brick stack located on the north side of the power plant.

4.0 PROJECT SCHEDULE

Mostardi Platt will provide the scope of services described above according to the following schedule:

Day	Activity	On-Site Hours
1	Travel to facility and set up equipment	2
2	Perform all flow, TPM, and HCl test runs	9
3	Perform all flow, Hg, NO _x , and CO test runs	8
4	Return travel	-

5.0 PROJECT PERSONNEL

Mostardi Platt will provide the following personnel to conduct the scope of services described above:

1 Project Manager
2 Test Engineers

6.0 TEST METHODOLOGY

Emission testing will be conducted following the methods specified in 40 CFR Part 60, Appendix A, and 40 CFR Part 51, Appendix M. Schematics of the sampling trains and data sheets to be used are included in the Appendix.

The following methodologies will be performed during the test program:

Method 1 and 2 Sample Point and Velocity Traverse Determination

The stack gas velocity and volumetric flowrate are determined using Reference Methods 1 and 2, 40 CFR, Part 60, Appendix A. The characteristic of the measurement location is summarized below.

Sample Point Selection

Location	Upstream Diameters	Downstream Diameters	Test Parameters	Number of Sampling Points
Exhaust Duct	> 0.5	> 2.0	HCl and Hg	1
			NO _x and CO	20
			TPM	25

Velocity pressures are determined by traversing the test location with an S-type pitot tube. Temperatures are measured using a K-type thermocouple with a calibrated digital temperature indicator. The molecular weight and moisture content of the gases are determined to permit the calculation of the volumetric flowrate. Sampling points utilized are determined using Method 1, 40CFR60.

3.0 SPECIFIC TEST PROCEDURES

Detailed test methodology is appended. Three (3) test runs will be performed at each specified Stack test location in accordance with the following USEPA Methods.

1. TPM test runs will be performed in accordance with United States Protection Agency (USEPA) Method 5, Title 40, Code of Federal Regulations Part 60, (40CFR60), Appendix A and Method 202, 40CFR51, Appendix M. Each test run will be 2 hours. The test train will be operated at 248°F (+/-25°F) and will utilize a glass probe liner.
2. Volumetric flow will be obtained from the Methods 5 sample train utilizing USEPA Methods 1, and 2, 40CFR60, Appendix A.
3. Oxygen (O₂) and carbon dioxide (CO₂) test runs will be performed utilizing USEPA Method 3A, 40CFR60, Appendix A (instrumental analyzer method). The average O₂ and CO₂ gas effluent concentrations for each run will be determined from the average gas concentrations displayed by the gas analyzers and adjusted for the zero and upscale sampling system bias checks immediately preceding and following each run.
4. Carbon monoxide (CO) test runs will be performed in accordance with USEPA Method 10, 40CFR60, Appendix A. Each run will be one-hour in length. The average CO concentration for each run will be determined from the average gas concentrations displayed by the gas analyzer and adjusted for the zero and upscale sampling system bias check immediately preceding and following each run.
5. Nitrogen oxides (NO_x) test runs will be performed in accordance with USEPA Method 7E, 40CFR60, Appendix A. Each run will be one-hour in length. The average NO_x concentration for each run will be determined from the average gas concentrations displayed by the gas analyzer and adjusted for the zero and upscale sampling system bias check immediately preceding and following each run.
6. Paired mercury (Hg) test runs will be completed and each test run will be one-hour in length. All temperature settings and quality assurance requirements of USEPA Method 30B will be followed.
7. Hydrochloric Acid (HCl) test runs will be performed in accordance with USEPA Method 26, 40CFR60, Appendix A. Each run will be one-hour in length.

1, 2, 3 A
S 10
7E
30B
26

Method 3A Oxygen (O₂) and Carbon Dioxide (CO₂) Determination

Stack gas O₂ and CO₂ concentrations will be determined in accordance with Method 3A. A Servomex analyzer will be used to determine O₂ and CO₂ concentrations during the particulate sampling. The instrument has a nondispersive infrared-based detector and operated in a range of 0% to the high-level span calibration gas.

A list of calibration gases that are used and the results of all calibration and other required quality assurance checks will be found in the Appendix of the final report. Copies of calibration gas certifications will also be found in the Appendix of the final report.

Method 10 Carbon Monoxide (CO) Determination

The Method 10 test procedure is used to determine the carbon monoxide (CO) concentrations. A continuous gas sample is extracted from a sampling point and analyzed for CO content using a nondispersive infrared (NDIR) analyzer. The gas stream is conditioned by condensing moisture and filtering particulate prior to the analyzer utilizing a straight extractive system. This instrument employs an internal gas correlation filter wheel that eliminates potential detector interference. Instruments so equipped do not require the use of an interference removal trap.

After an appropriate warm-up time, the analyzer is calibrated using calibration gases at concentrations corresponding to approximately 50, and 90% of the applicable source span, with a CO free calibration gas used as a zero gas.

The analyzer calibration is verified with the mid-range and zero gases after each test run.

A twelve point stratification test will be performed during **run one** to determine the number of test points for the ensuing two runs as described in USEPA Method 7E, 40CFR60, Appendix A.

A list of calibration gases that are used and the results of all calibrations will be presented in the Appendix of the final report. Copies of calibration gas certifications will also be appended to the final report.

Method 7E Nitrogen Oxides Determination

Stack gas nitrogen oxide concentrations and emission rates are determined in accordance with Method 7E, 40CFR60, Appendix A. A Thermo Environmental nitrogen oxide analyzer is used to determine nitrogen oxide concentrations, in the manner specified in the Method.

Stack gas is delivered to the analyzer via a Teflon sampling line, heated to a minimum temperature of 250 °F. Excess moisture in the stack gas is removed using a refrigerated condenser. The entire system is calibrated in accordance with the Method, using certified calibration gases introduced at the probe, before and after each test run. A molybdenum converter is used in order to convert nitrogen oxide to nitrogen dioxide, for analytical purposes, without converting any other chemically-bound nitrogen species, such as ammonia, that might be present in the gas stream.

A 12-point stratification test will be performed during run one. The results of the stratification test will be used to determine sampling points required for the test location in accordance with Method 7E, 40CFR60, Appendix A.

A list of calibration gases used and the results of all calibration and other required quality assurance checks will be found in the Appendix of the final report. Copies of calibration gas certifications will also be found in the Appendix of the final report.

Method 26 Hydrogen Chloride (HCl) Determination

Hydrogen chloride concentrations and emission rates will be determined in accordance with Method 26. An Environmental Supply Company, Inc. sampling train will be used to sample stack gas, in the manner specified in the Method. A single-point sample will be extracted from the gas stream and passed through dilute (0.1 N) sulfuric acid. In the dilute acid, the HCl will dissolve and form chloride (Cl) ions. The chloride ions will then be analyzed by ion chromatography. The sample train consists of a Teflon® filter placed on the inlet of a heated borosilicate glass probe liner, a heated 3-way valve, and five midget impingers. The first two impingers contain the dilute sulfuric acid, the second two impingers contain a 0.1 N sodium hydroxide (NaOH) scrubber solution to remove any remaining chlorine, and the fifth impinger contains silica gel to absorb any remaining moisture. Prior to sampling, the probe and filter will be purged for 5 minutes at a 2-liter/min rate. The sample is then extracted at a flowrate of 2 liter/min. A DI rinse will be performed on each set of two impingers, and samples are stored in Nalgene sample containers for transport. All of the equipment used is calibrated in accordance with the specifications of the Method.

Method 30B Mercury Determination (Sorbent Trap Method)

Paired trains will be utilized using three test points at the Unit 1 Baghouse Outlet Duct test location.

Per Method 30B sampling, each sample will be collected on the paired in-situ sorbent traps. A tube of silica is used to capture remaining moisture prior to the sample reaching the gas metering system.

The sample train used for this test program is designed by APEX, Inc. and meets all requirements for Method 30B sampling. Samples will be analyzed utilizing an Ohio Lumex, Inc. analyzer for mercury concentration.

Method 5 Particulate Matter Determination

A total of 24 test points using two ports at the Siloxane Flare test location will be sampled.

Particulate matter will be sampled in accordance with reference test USEPA Method 5, 40CFR60, Appendix A. The particulate matter sampling train is manufactured by Graseby/Nutech Corporation of Durham, North Carolina and meets all specifications required by Method 5. A glass-lined probe is used. Drawings depicting the sampling ports, test point locations, and sampling trains are appended to this protocol. Velocity pressures are determined simultaneously during sampling with a calibrated S-type pitot tube and inclined manometer. All temperatures are measured using K-type thermocouples with calibrated digital temperature indicators. The probe and filter temperatures will be maintained at 250 degrees F during the test program.

The quartz glass filter media are Whatman QMA 1851-082. All sample contact surfaces of the train are washed with HPLC reagent-grade acetone. These washes are placed in sealed and marked containers for analysis.

All sample recovery is performed at the test site by the test crew. All final particulate sample analyses are performed by Mostardi Platt personnel at the laboratory in Elmhurst, Illinois. Copies of all sample analysis sheets, explanations of nomenclature and calculations, and raw field data sheets are appended to this protocol.

Method 202 Condensable Particulate Determination

Stack gas condensable particulate concentrations and emission rates will be determined in accordance with the Method 202, in conjunction with Method 5 or 201A filterable particulate sampling. Condensable particulate matter is collected in the impinger portion of the sampling train.

The condensable particulate matter (CPM) is collected in impingers after filterable particulate material is collected utilizing Method 5 or 201A. The organic and aqueous fractions are then taken to dryness and weighed. The total of all fractions represents the CPM. Compared to the December 17, 1991 promulgated Method 202, this Method includes the addition of a condenser, followed by a water dropout impinger immediately after the final heated filter. One modified Greenburg Smith impinger and an ambient temperature filter follow the water dropout impinger. A schematic of the sampling train configured with these updates is found in the Appendix.

CPM is collected in the water dropout, modified Greenburg Smith impinger and ambient filter portion of the sampling train as described in this Method. The impinger contents are purged with nitrogen (N_2) immediately after sample collection to remove dissolved sulfur dioxide (SO_2) gases from the impingers. The impinger solution is then extracted with DI water, acetone, and hexane. The organic and aqueous fractions are dried and the residues weighed. The total of the aqueous, organic, and ambient filter fractions represents the CPM. A field blank will be collected.

7.0 QUALITY ASSURANCE PROCEDURES

Mostardi Platt recognizes the previously described reference methods to be very technique oriented and attempts to minimize all factors that can increase error by implementing its Quality Assurance Program into every segment of its testing activities.

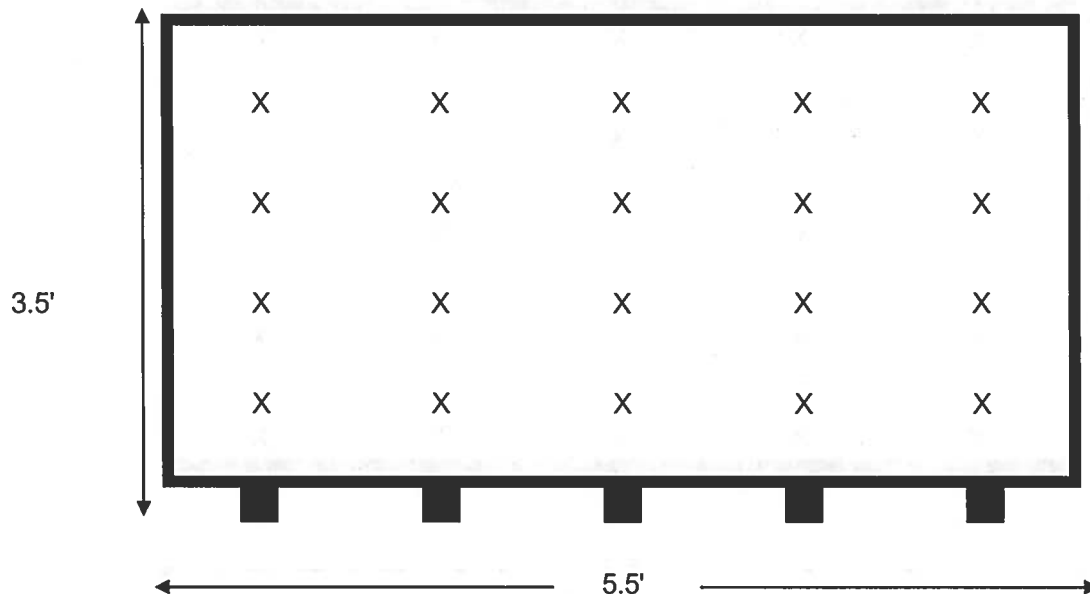
Calculations are performed by computer. An explanation of the nomenclature and calculations along with the complete test results will be appended in the final report. Also to be appended are the calibration data and copies of the raw field data sheets. Analyzer interference data is kept on file at Mostardi Platt.

Dry gas meters are calibrated according to methods described in the Code of Federal Regulations. The dry test meters measure the test sample volumes to within 2 percent at the flowrate and conditions encountered during sampling.

APPENDIX

EQUAL AREA TRAVERSE FOR RECTANGULAR DUCTS

(Gaseous Stratification Test)



Job: University of Iowa
Oakdale Renewable Energy
Plant

Date: 5/17/12

Area: 19.25 Square Feet

Test Location: Hurst Boiler Exhaust Duct

No. Test Ports: 5

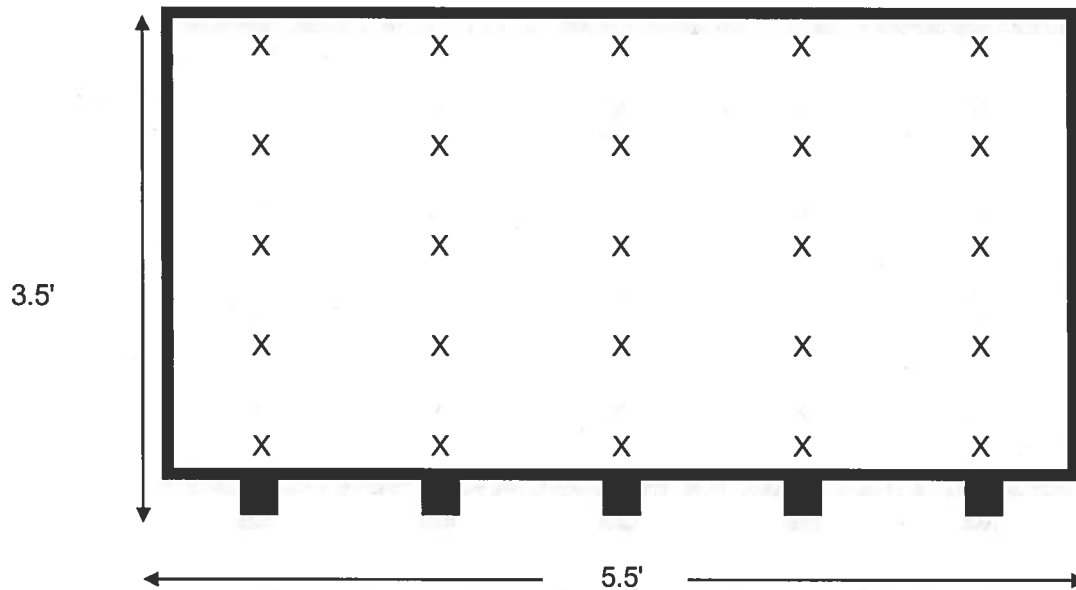
Length: 5.5 Feet

Tests Points per Port: 4

Width: 3.5 Feet

EQUAL AREA TRAVERSE FOR RECTANGULAR DUCTS

(Particulate Test)



Job: University of Iowa
Oakdale Renewable Energy
Plant

Date: 5/17/12

Area: 19.25 Square Feet

Test Location: Hurst Boiler Exhaust Duct

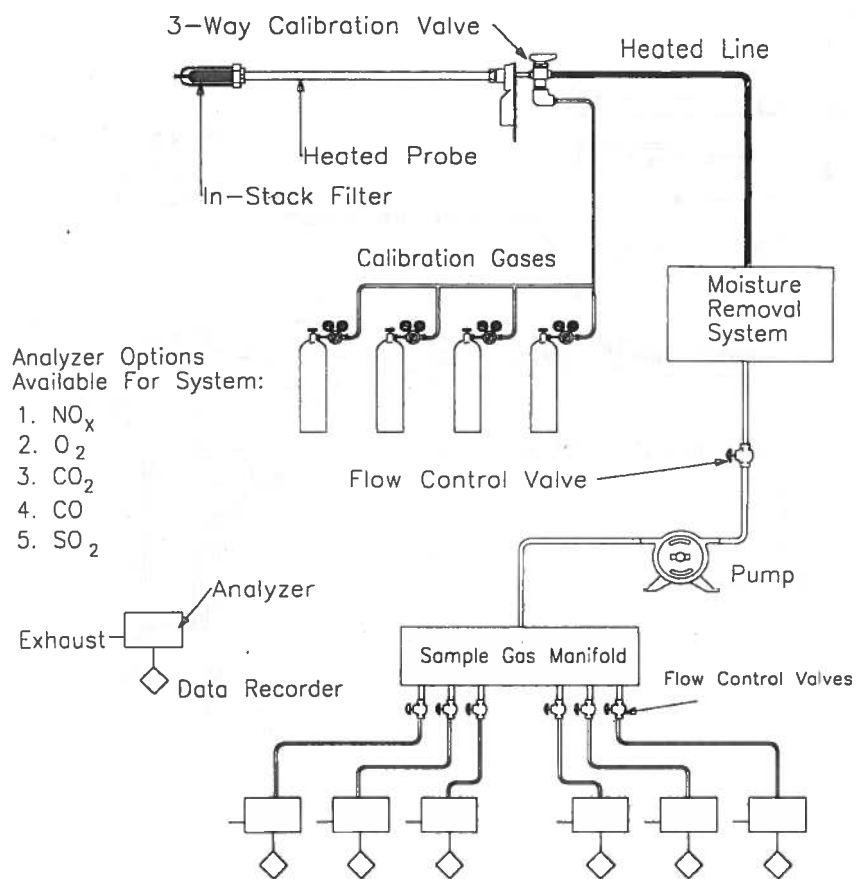
No. Test Ports: 5

Length: 5.5 Feet

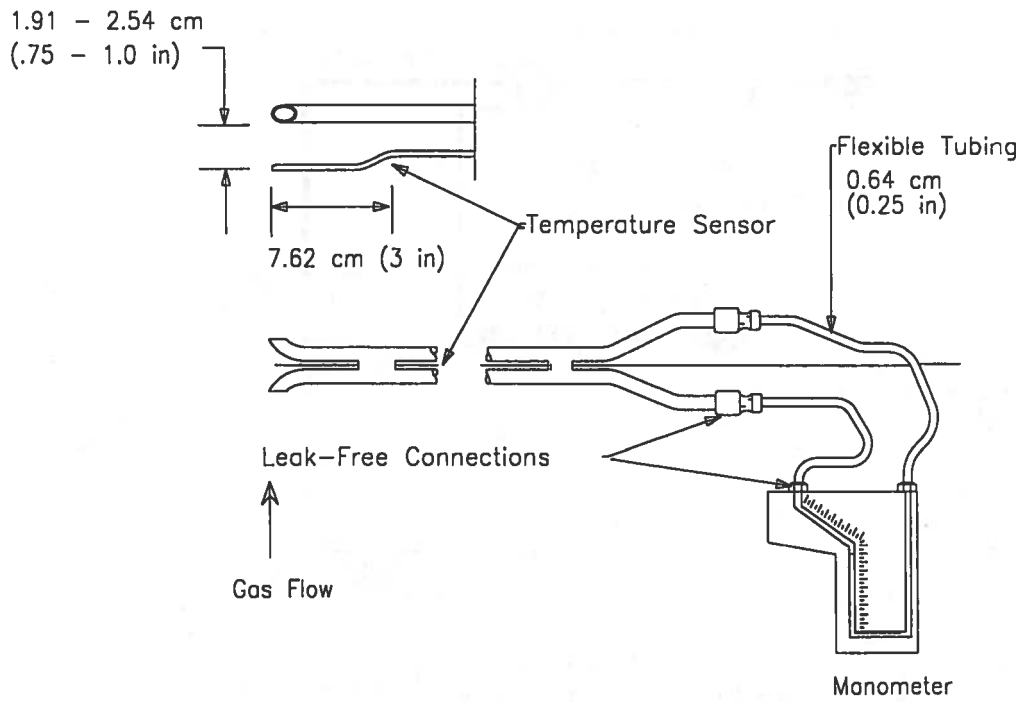
Tests Points per Port: 5

Width: 3.5 Feet

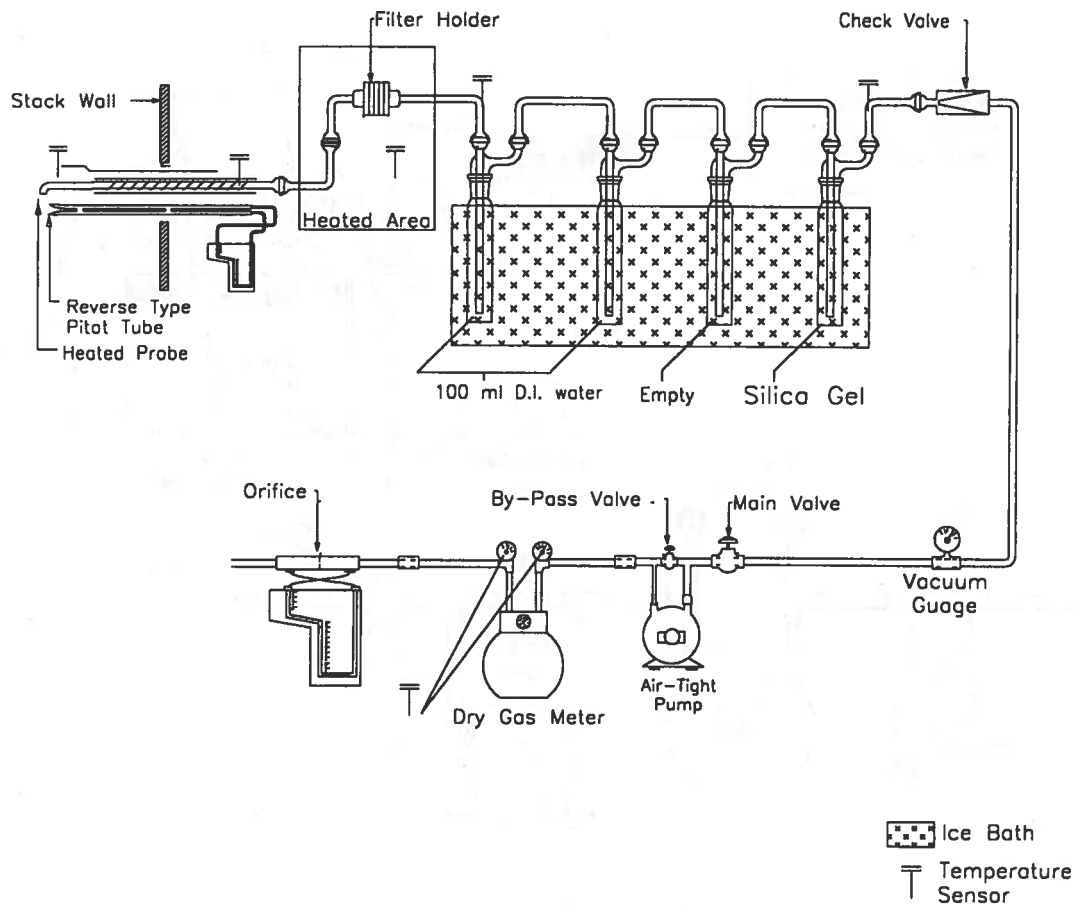
USEPA Method 3A, 7E, and 10 Extractive Gaseous Sampling Diagram



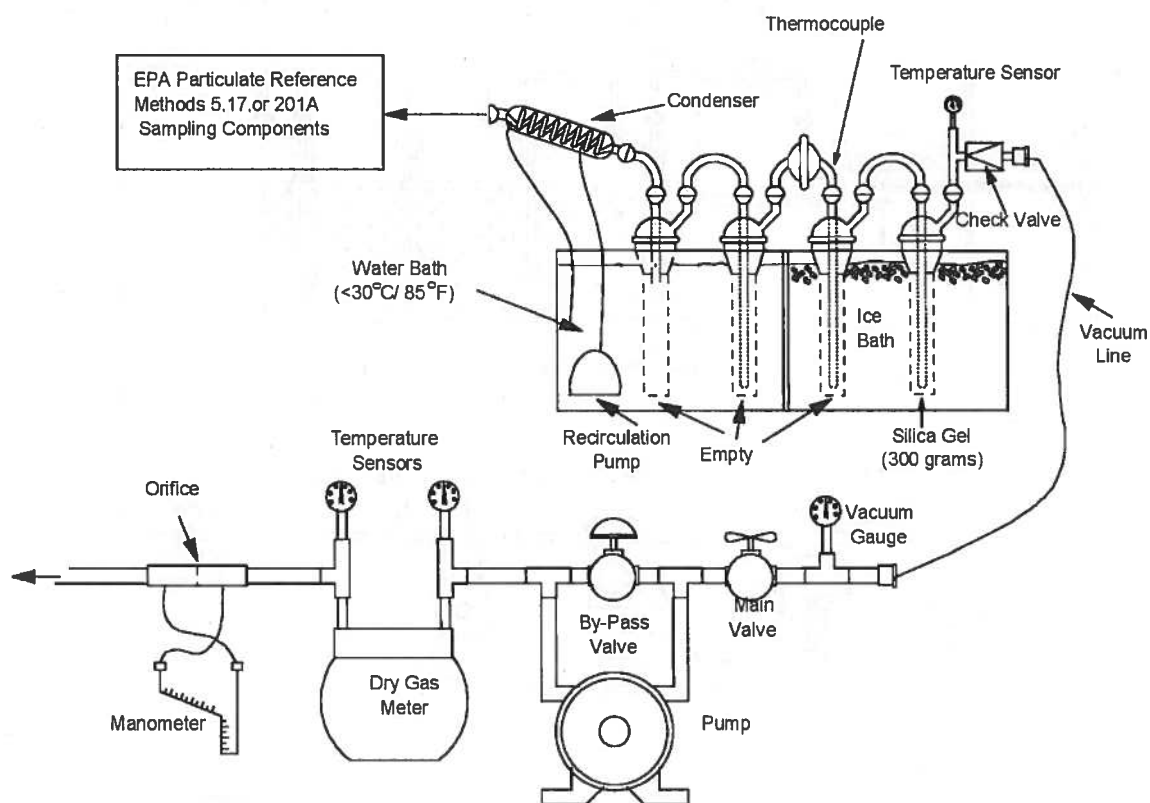
USEPA Method 2 - S-Type Pitot Tube Diagram



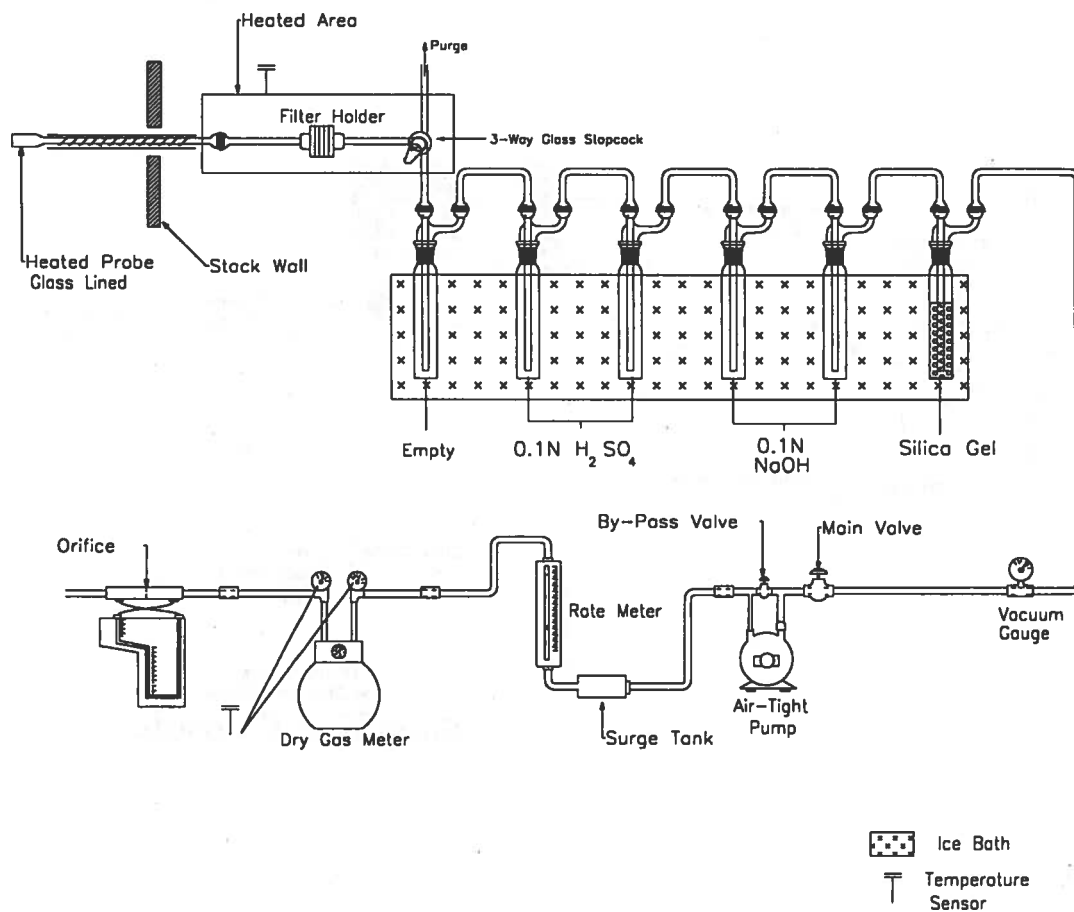
USEPA Method 5 - Particulate Matter Sample Train Diagram



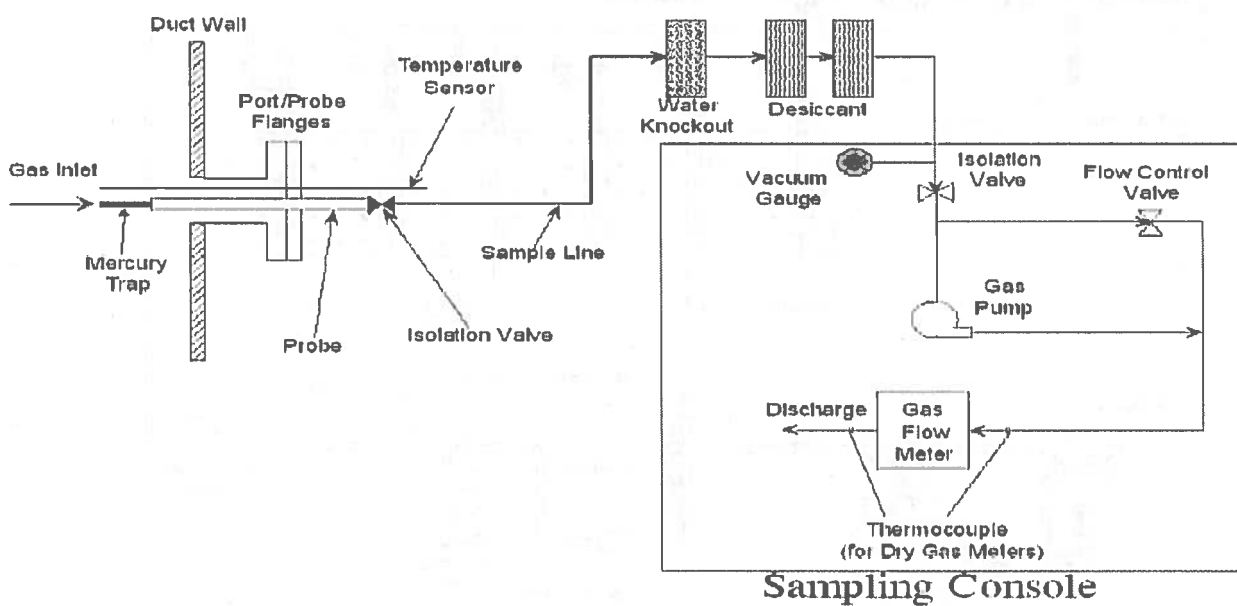
USEPA 202- Dry Impinger Method for Determining Condensable Particulate Emissions from Stationary Sources



USEPA Method 26 – Halogen Sample Train Diagram



USEPA Method 30B – Typical Mercury Sorbent Trap Sampling System



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Particulate Nomenclature

- A = Cross-sectional area of stack or duct, square feet
A_n = Cross-sectional area of nozzle, square feet
B_{ws} = Water vapor in gas stream, by volume
C_a = Acetone blank residue concentration, g/g
C_{acf} = Concentration of particulate matter in gas stream at actual conditions, gr/acf
C_p = Pitot tube coefficient
C_s = Concentration of particulate matter in gas stream, dry basis, corrected to standard conditions, gr/dscf
IKV = Isokinetic sampling variance, must be 90.0 % ≤ IKV ≤ 110.0%
M_d = Dry molecular weight of gas, lb/lb-mole
M_s = Molecular weight of gas, wet basis, lb/lb-mole
M_w = Molecular weight of water, 18.0 lb/lb-mole
m_a = Mass of residue of acetone after evaporation, grams
P_{bar} = Barometric pressure at testing site, inches mercury
P_g = Static pressure of gas, inches mercury (inches water/13.6)
P_s = Absolute pressure of gas, inches mercury = P_{bar} + P_g
P_{std} = Standard absolute pressure, 29.92 inches mercury
Q_{acfm} = Actual volumetric gas flow rate, acfm
Q_{sd} = Dry volumetric gas flow rate corrected to standard conditions, dscfh
R = Ideal gas constant, 21.85 inches mercury cubic foot/°R-lb-mole
T_m = Dry gas meter temperature, °R
T_s = Gas temperature, °R
T_{std} = Absolute temperature, 528°R
V_a = Volume of acetone blank, ml
V_{aw} = Volume of acetone used in wash, ml
W_a = Weight of residue in acetone wash, grams
m_n = Total amount of particulate matter collected, grams
V_{1c} = Total volume of liquid collected in impingers and silica gel, ml
V_m = Volume of gas sample as measured by dry gas meter, dcf
V_{m(std)} = Volume of gas sample measured by dry gas meter, corrected to standard conditions, dscf
v_s = Gas velocity, ft/sec
V_{w(std)} = Volume of water vapor in gas sample, corrected to standard conditions, scf
Y = Dry gas meter calibration factor
ΔH = Average pressure differential across the orifice meter, inches water
Δp = Velocity head of gas, inches water
ρ_a = Density of acetone, 0.7855 g/ml (average)
ρ_w = Density of water, 0.002201 lb/ml
θ = Total sampling time, minutes
K₁ = 17.647 °R/in. Hg
K₂ = 0.04707 ft³/ml
K₄ = 0.09450/100 = 0.000945
Pitot tube constant,
K_p =
%EA = Percent excess air
%CO₂ = Percent carbon dioxide by volume, dry basis
%O₂ = Percent oxygen by volume, dry basis
%CO = Percent carbon monoxide by volume, dry basis
%N₂ = Percent nitrogen by volume, dry basis
0.264 = Ratio of O₂ to N₂ in air, v/v
28 = Molecular weight of N₂ or CO
32 = Molecular weight of O₂
44 = Molecular weight of CO₂
13.6 = Specific gravity of mercury (Hg)

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Particulates Calculation Formulas

$$1. V_{w(std)} = V_{lc} \left(\frac{\rho_w}{M_w} \right) \left(\frac{RT_{std}}{P_{std}} \right) = K_2 V_{lc}$$

$$2. V_{m(std)} = V_m Y \left(\frac{T_{std}}{T_m} \right) \left(\frac{(P_{bar} + (\frac{\Delta H}{13.6}))}{P_{std}} \right) = K_1 V_m Y \frac{(P_{bar} + (\frac{\Delta H}{13.6}))}{T_m}$$

$$3. B_{ws} = \frac{V_{w(std)}}{(V_{m(std)} + V_{w(std)})}$$

$$4. M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

$$5. M_s = M_d(1 - B_{ws}) + 18.0(B_{ws})$$

$$6. C_a = \frac{m_a}{V_a \rho_a}$$

$$7. W_a = C_a V_{aw} \rho_a$$

$$8. C_{acf} = 15.43 K_i \left(\frac{m_n P_s}{V_{w(std)} + V_{m(std)} T_s} \right)$$

$$9. C_s = (15.43 \text{ grains/gram}) (m_n / V_{m(std)})$$

$$10. v_s = K_p C_p \sqrt{\frac{\Delta P T_s}{P_s M_s}}$$

$$11. Q_{acfm} = v_s A (60_{\text{sec/min}})$$

$$12. Q_{sd} = (3600_{\text{sec/hr}})(1 - B_{ws}) v_s \left(\frac{T_{std} P_s}{T_s P_{std}} \right) A$$

$$13. E \text{ (emission rate, lbs/hr)} = Q_{std} (C_s / 7000 \text{ grains/lb})$$

$$14. IKV = \frac{T_s V_{m(std)} P_{std}}{T_{std} v_s \theta A_n P_s 60(1 - B_{ws})} = K_4 \frac{T_s V_{m(std)}}{P_s v_s A_n \theta (1 - B_{ws})}$$

$$15. \%EA = \left(\frac{\%O_2 - (0.5 \%CO)}{0.264 \%N_2 - (\%O_2 - 0.5 \%CO)} \right) \times 100$$

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Derivation of Factors Used in Carbon Monoxide and Nitrogen Oxides Calculations

Factors for calculating from lb/dscf to parts per million:

Using 22.414 liters of gas per gram-mole at 0°C and 1 atmosphere pressure,

One pound-mole of gas is contained in 359.04765 ft³ at 32°F and 29.92 in. Hg, or 385.31943 ft³ at 68°F and 29.92 in. Hg

$$\text{ppm} = \frac{M \text{ lb/lb-mole}}{385.31943 \text{ dscf/lb-mole} \times 10^6} = 2.5952494 \times 10^{-9} M \text{ lb/dscf}$$

Where M = pollutant molecular weight; CO = 28.01 lb/lb-mole; and NO₂ = 46.0055 lb/lb-mole

$$\text{Factor for ppm CO} = \frac{1}{28.01 \times 2.5952494 \times 10^{-9}} = 1.3762 \times 10^7 \text{ dscf/lb}$$

Use 1.3762 × 10⁷

$$\text{Factor for ppm NO}_x = \frac{1}{46.0055 \times 2.5952494 \times 10^{-9}} = 8.3755 \times 10^6 \text{ dscf/lb}$$

Use 8.3755 × 10⁶

Factors for calculating concentration as pounds per dry standard cubic feet:

$$\begin{aligned} \text{Factor for } C_{\text{CO}} &= \frac{28.01 \text{ grams/gram-mole}}{2 \frac{\text{gram-equivalents}}{\text{gram-mole}} \times 1000 \frac{\text{gram-milliequivalents}}{\text{gram-equivalent}} \times 453.592 \frac{\text{grams}}{\text{lb}}} \\ &= 3.087577 \times 10^{-5} \text{ lb/g-meq} \quad \text{Use } 3.0876 \times 10^{-5} \end{aligned}$$

$$\text{Factor for } C_{\text{NO}_2} \text{ as NO}_2 = \frac{28316.846 \text{ ml/scf}}{4.53592 \times 10^8 \frac{\mu\text{g}}{\text{lb}}} = 6.242801 \times 10^{-5} \frac{\text{lb/scf}}{\mu\text{g/ml}} \quad \text{Use } 6.2428 \times 10^{-5}$$

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ppm Conversion Calculations and Factors

ppm to lbs/scf

$$(\text{ppm } X) \times (\text{conversion factor } X) = X \text{ lbs/scf}$$

lbs/scf to lbs/hr

Dry ppm's with dry flow, and wet ppm's with wet flow.

$$(X \text{ lbs/scf}) \times (\text{airflow scf/min}) \times (60 \text{ min/hr}) = X \text{ lbs/hr}$$

lbs/scf to lbs/mmBtu

Dry ppm's with dry diluent, and wet ppm's with wet diluent.

$$\text{CO}_2 - (X \text{ lbs/scf}) \times (F_c) \times (100/\text{CO}_2) = X \text{ lbs/mmBtu}$$

$$\text{O}_2 - (X \text{ lbs/scf}) \times (F_d) \times (20.9/(20.9-\text{O}_2)) = X \text{ lbs/mmBtu}$$

Conversion Factors

$$\text{NO}_x - 1.19396 \times 10^{-7}$$

$$\text{CO} - 7.2664 \times 10^{-8}$$

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Calculations for Hydrogen Chloride by Method 26A

Concentration

$$\frac{\text{lb HCl}}{\text{dscf}} = \frac{\mu\text{g HCl in sample}}{4.536 \times 10^8 \times \text{dscf}}$$

where:

$$4.536 \times 10^8 = \mu\text{g/lb}$$

dscf = Volume of gas sampled

$$\mu\text{g/lb HCl} = \mu\text{g Cl} \times \frac{36.453}{35.453}$$

Parts Per Million

$$\text{ppm HCl} = \frac{\text{lb HCl}}{\text{dscf}} \div \frac{36.453}{385 \times 10^6}$$

where:

385 = Volume of 1 lb mole of gas at 68°F and 29.92 in. Hg

10^6 = Conversion of ppm v/v

Emission Rate

$$\text{lb HCl/dscf} \times \text{dscfm} \times 60 \text{ min/hr} = \text{lb/hr HCl}$$

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Mercury Sample Calculations

Concentration

$$\frac{\text{ng}}{\text{m}^3} = \frac{\text{ng of mercury}}{\text{dscf volume sampled} \times 0.02832 \frac{\text{m}^3}{\text{ft}^3}}$$

Emission Rate

$$\frac{\text{ng of sample} \times \frac{1 \times 10^{-9} \text{ grams}}{\text{ng}}}{453.6 \text{ gr/lb}} = \text{lbs of mercury}$$

$$\frac{\text{lbs of mercury}}{\text{Vm (std) sample}} \times \text{dscfm} \times 60 \frac{\text{min}}{\text{hr}} = \text{lbs of mercury/hr}$$

MOSTARDI PLATT

Procedures for Calibration

Nozzles

The nozzles are measured according to Method 5, Section 5.1

Dry Gas Meters

The test meters are calibrated according to Method 5, Section 5.3 and "Procedures for Calibrating and Using Dry Gas Volume Meters as Calibration Standards" by P.R. Westlin and R.T. Shigehara, March 10, 1978.

Analytical Balance

The accuracy of the analytical balance is checked with Class S, Stainless Steel Type 303 weights manufactured by F. Hopken and Son, Jersey City, New Jersey.

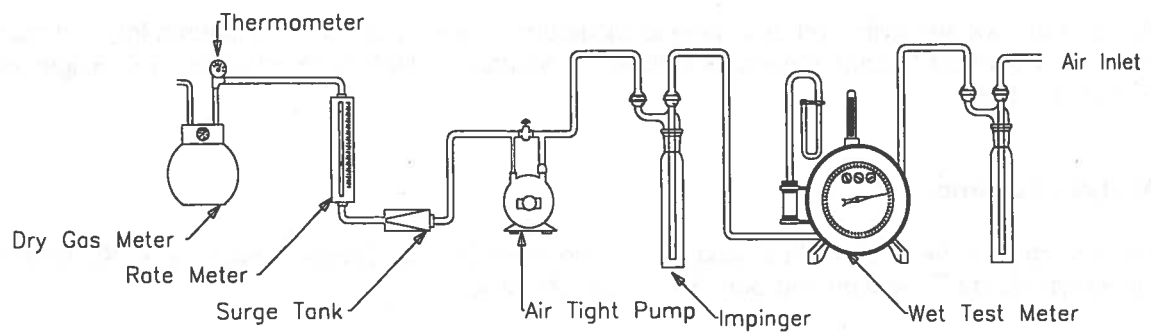
Temperature Sensing Devices

The potentiometer and thermocouples are calibrated utilizing a NBS traceable millivolt source.

Pitot Tubes

The pitot tubes utilized during this test program are manufactured according to the specification described and illustrated in the *Code of Federal Regulations*, Title 40, Part 60, Appendix A, Methods 1 and 2. The pitot tubes comply with the alignment specifications in Method 2, Section 4; and the pitot tube assemblies are in compliance with specifications in the same section.

Dry Gas Meter Calibration Sample Train Diagram



Dry Gas Meter No. CM-1
 Standard Meter No. _____
 Standard Meter (Y) _____

Date: _____
 Calibrated By: _____
 Barometric Pressure: _____

Run Number	Orifice Setting in H ₂ O Chg (H)	Standard Meter Gas Volume vr	Dry Gas Meter Gas Volume vd	Standard Meter Temp. F° tr	Dry Gas Meter Inlet Temp. F° tdi	Dry Gas Meter Outlet Temp. F° tdo	Dry Gas Meter Avg. Temp. F° td	Time Min	Time Sec	Y	Chg (H)
Final											
Initial											
Difference 1	0.20										
Final											
Initial											
Difference 2	0.50										
Final											
Initial											
Difference 3	0.70										
Final											
Initial											
Difference 4	0.90										
Final											
Initial											
Difference 5	1.20										
Final											
Initial											
Difference 6	2.00										

Average _____

Stack Temperature Sensor Calibration

Meter Box # : CM-1

Name : _____

Ambient Temperature : _____ °F

Date : _____

Calibrator Model # : _____

Serial # : _____

Date Of Certification : _____

Primary Standards Directly Traceable National Institute of Standards and Technology (NIST)

Reference Source Temperature (° F)	Test Thermometer Temperature (° F)	Temperature Difference %
0		0.0
250		0.0
600		0.0
1200		0.0

$$\frac{(\text{Ref. Temp., } ^\circ\text{F} + 460) - (\text{Test Therm. Temp., } ^\circ\text{F} + 460)}{\text{Ref. Temp., } ^\circ\text{F} + 460} * 100 \leq 1.5 \%$$

Ref. Temp., °F + 460

Nozzle Calibration Sheet

PM 2.5 Set #1

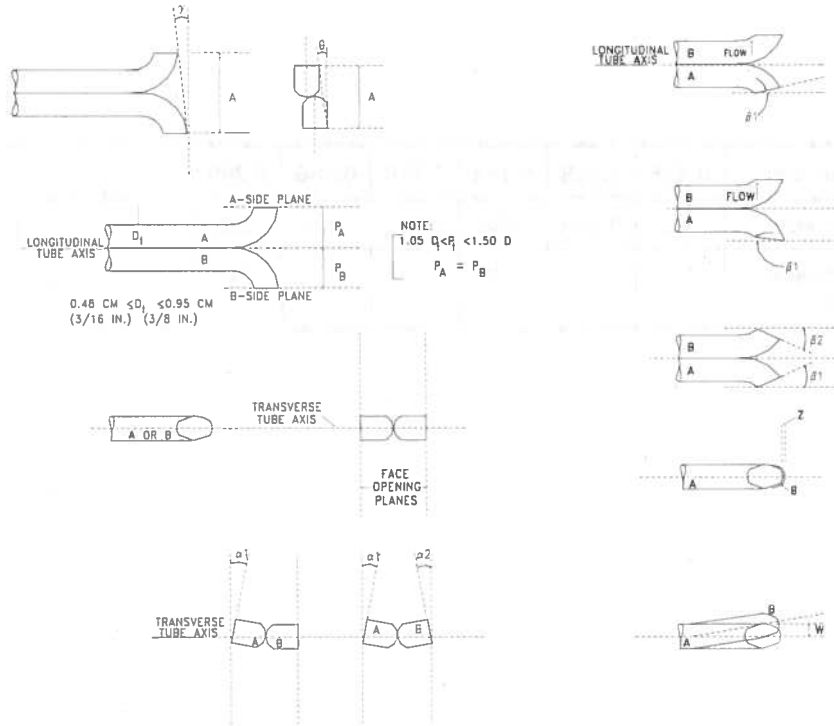
Nominal Diameter	0.128	0.138	0.154	0.170	0.186	0.200					Other
Nozzle Diameter	.128	0.138	.154	0.174	0.186	.200					
Nozzle Identification Number	1-1	1-2	1-3	1-4	1-5	1-6					

S TYPE PITOT TUBE INSPECTION FORM

Pitot Tube No: 1

Date: _____

Inspectors Name: _____



Pitot tube assembly level? ☒ yes ☐ no

Pitot tube openings damaged? ☐ yes (explain below) ☒ no

$a_1 = 1^\circ (<10^\circ)$, $a_2 = 1^\circ (<10^\circ)$

$z = A \sin g = 0.008$ (in.); (<0.125 in.)

$b_1 = 0^\circ (<5^\circ)$, $b_2 = 2^\circ (<5^\circ)$

$w = A \sin q = 0.025$ (in.); (<0.03125 in.)

$\gamma = 0.5^\circ$, $\theta = 1.5^\circ$, $A = 0.938$ (in.)

$P_A = 0.477$ (in.), $P_B = 0.477$ (in.), $D_t = 0.375$ (in.)

Calibration required? ☐ yes ☒ no

CALIBRATION SUMMARY

Project Number: _____
Client: _____
Test Location: _____

Date: _____
Operator: _____
Box Truck: _____

Analyzer Type, S/N, and Span	Cal Level	Cylinder ID Serial Number	Expected Cal Value	Actual Response	Difference As % of Span	Cylinder Pressure (psi)	Cylinder Expiration Date
NO _x	Zero						
	Mid						
	High						
SO ₂	Zero						
	Mid						
	High						
O ₂	Zero						
	Mid						
	High						

Gaseous Calibration Summary

Project: _____
Client: _____
Location: _____

Date: _____

Operator: _____

Analyzer ID: _____

Analyzer Range: _____

[illegible]

Method 30B Chain of Custody

Plant/Source: _____ Test Location: _____

Test ID: _____ Carbon Trap ID: OL10956

Spiked At: _____ QA/QC Signature _____

Sampled By: _____ Sampling Console Ser# _____

Test Start (Date/Time):	Leak Check Pass/Fail	Test End (Date/Time):	Leak Check Pass/Fail
----------------------------	-------------------------	--------------------------	-------------------------

Date	Time	DUCT Temp (°F or °C)	Meter Temp (°F or °C)	Flow Rate (cc/min)	Dry Gas Meter Liters Initial	Dry Gas Meter Liters Final	Comments
Total/Average							

Chain of Custody

Relinquished by: _____	Date: _____
Received by: _____	Date: _____
Relinquished by: _____	Date: _____
Received for Laboratory by: _____	Date: _____

For Analysis contact us at 330-405-0837
 Ohio Lumex Co., Inc. 9263 Ravenna Road Unit A-3, Twinsburg, OH 44087 USA
 330-405-0837 FAX 330-405-0847 US Toll Free: 888-876-2611

Impregnated Activated Carbon – Refer to MSDS
 Deactivated glass and glass wool

GASEOUS FIELD DATA SHEET

Project Number: _____
Client: _____
Test Location: _____

Date: _____
Operator: _____
Fuel Factor: _____

[illegible][illegible]

Volumetric Flow Rate Determination Field Data Sheet

Project Number: _____
 Client: _____
 Test Location: _____
 Source Condition: _____
 Test Engineer: _____

Date: _____

Test Number: _____

Start Time: _____

End Time: _____

Test Tech: _____

Duct Diameter _____ ft Upstream Disturbance, Diameters _____
 Flue Area _____ ft² Downstream Disturbance, Diameters _____
 Port Length _____ " Pitot ID _____ Pitot Coefficient (Cp) _____
 P_{bar} _____ "Hg CO₂ % _____ Wet Bulb Temp _____ Leak Checks _____
 Static _____ "H₂O O₂ % _____ Dry Bulb Temp _____ Pre _____
 Static _____ "Hg N₂ % B_{ws} _____ Post _____
 P_s _____ "Hg Meter No. _____

[illegible]

$$.44 \times \text{CO}_2\% + .32 \times \text{O}_2\% + .28 \times \text{N}_2\% = \text{_____}(\text{Md})$$

$$(\text{Md} \times 1 - \text{Bws}) + (18 \times \text{Bws}) = \text{Ms}$$

$$85.49 \times \text{Cp} \times \sqrt{\frac{(\text{) T}_s \text{ } ^\circ\text{R}}{\text{Ms} \times \text{Ps}}} \times \text{ } \sqrt{\Delta P} = \text{ } \text{ft/sec (Vs)}$$

_____ Vs x _____ Flue Area x 60 = _____ acfm

$$17.647 \times \text{acfm} \times \frac{P_s}{T_s \text{ } ^\circ R} = \text{scfm} \times 60 = \text{scfh}$$

M26 HYDROGEN CHLORIDE FIELD DATA SHEET

ProjectName/Number: _____ Date: _____
 SamplingLocation: _____ SourceCondition: _____
 Dry Gas Meter No. _____ Y = _____ Test Engineer: _____

Test (Run) No. _____		Barometric Pressure (P _{bar}) _____ in. Hg			Orsat Analysis	
Gas Temperature _____ °F		Static Pressure _____ in. Hg			%CO ₂ _____	%O ₂ _____
Clock Time	Meter Volume (V _m) ft ³ or L (Circle One)	Meter Gage Pressure (ΔH) in. H ₂ O	Meter Temp. (t _m) °F	Impgr. Outlet Temp °F	Condensate	Silica Gel or Train
24 hour						
					_____ mls (V _i)	_____ grams (W _i)
					- _____ mls (V _i)	- _____ grams (W _i)
					_____ mls	_____ grams
					× 0.04707 = _____	× 0.04715 = _____
					_____ ft ³ [V _{wc(std)}] + _____ ft ³ [V _{wsg(std)}]	
						= _____ ft ³ [V _{w(std)}]
					V _{m(std)} = _____ ft ³	
					Water Vapor, proportion by volume	
					Leak Check:	B _{ws} = _____
						Moisture correction factor:
						1 - B _{ws} = _____
Total Vol.					Comments:	
Average			(T _m)	°R		

Test (Run) No. _____		Barometric Pressure (P _{bar}) _____ in. Hg			Orsat Analysis	
Gas Temperature _____ °F		Static Pressure _____ in. Hg			%CO ₂ _____	%O ₂ _____
Clock Time	Meter Volume (V _m) ft ³ or L (Circle One)	Meter Gage Pressure (ΔH) in. H ₂ O	Meter Temp. (t _m) °F	Impgr. Outlet Temp °F	Condensate	Silica Gel or Train
24 hour						
					_____ mls (V _i)	_____ grams (W _i)
					- _____ mls (V _i)	- _____ grams (W _i)
					_____ mls	_____ grams
					× 0.04707 = _____	× 0.04715 = _____
					_____ ft ³ [V _{wc(std)}] + _____ ft ³ [V _{wsg(std)}]	
						= _____ ft ³ [V _{w(std)}]
					V _{m(std)} = _____ ft ³	
					Water Vapor, proportion by volume	
					Leak Check:	B _{ws} = _____
						Moisture correction factor:
						1 - B _{ws} = _____
Total Vol.					Comments:	
Average			(T _m)	°R		

$$V_{m(std)} = 17.64 V_m Y \frac{P_{bar} + \frac{DH}{13.6}}{T_m}$$

$$B_{ws} = \frac{V_{w(std)}}{V_{w(std)} + V_{m(std)}}$$

MERCURY SORBENT TRAP FIELD DATA SHEET

Project Name/Number: _____ Sampling Location: _____ Run Number: _____
 Date: _____ Barometric Pressure: _____
 Source Condition: _____ Test Engineer: _____
 Dry Gas Meter No. _____ Y = _____ Trap Number _____

Sample Train A					
Clock Time	Stack Temp. °F	Sorbent Trap Temp. °F	Meter Temp. (t _m) °F	Meter Volume (V _m) liters	Meter Vacuum, "Hg
24 hour					
Total/Average					

Dry Gas Meter No. _____ Y = _____ Trap Number _____ Spike Value _____ ng

Sample Train B					
Clock Time	Stack Temp. °F	Sorbent Trap Temp. °F	Meter Temp. (t _m) °F	Meter Volume (V _m) liters	Meter Vacuum, "Hg
24 hour					
Total/Average					

Train A: Pre-Test Leak Check – Pass @ _____ "Hg
 Post-Test Leak Check – Pass @ _____ "Hg
 Train B: Pre-Test Leak Check – Pass @ _____ "Hg
 Post-Test Leak Check – Pass @ _____ "Hg

Isokinetic Sampling Cover Sheet

Test Engineer: _____
 Test Technician: _____

Plant Information	
Run Number: _____	Date: _____
Test Location: _____	Client Name: _____
Duct Shape: Circular or Rectangular	Length: _____ or Width: _____
Flue Area: _____	Upstream Diameters: _____
Port Type: _____	Port Length: _____
Test Method: _____	Source Condition: _____
	Project Number: _____
	Plant Name: _____
	Diameter: _____
	Downstream Diameters: _____
	Port Diameter: _____

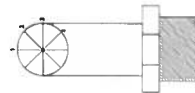
Meter and Probe Data	
Meter ID: _____	Meter Y Value: _____
Pitot ID: _____	Pitot Coefficient: _____
Nozzle Kit ID _____	Nozzle Diameter: _____
Probe Length: _____	Probe Liner: _____
Pre-Test Nozzle Leak Check: _____	Post-Test Nozzle Leak Check: _____
Pre-Test Pitot Leak Check: _____	Post-Test Pitot Leak Check: _____
	Train Type: _____
	Filter Number/Weight: _____
	Thimble Number/Weight: _____
	@ _____
	"Hg _____
	"H ₂ O _____

Traverse Data	
Ports Sampled: _____	Points/Port: _____
Total Points: _____	Total Test Time: _____
	Min/Point: _____
	Sample Plane: Horizontal or Vertical

Stack Parameters	
Barometric Pressure: _____	Static Pressure: _____
CO ₂ %: _____ / Avg. _____ / _____	O ₂ %: _____ / Avg. _____
Imp and/or silica balance Model and S/N: _____	Servomex Serial #: _____
Initial Imp. Volume or Weight: _____	Final Imp. Volume or Weight: _____
Initial Silica Weight: _____	Final Silica Weight: _____
	Imp. Volume or Weight Gain: _____
	Silica Weight Gain: _____

Comments: _____

Post-Test Nozzle Verification: 1) _____ 2) _____ 3) _____ 4) _____



ATTACHMENT 3



Fw: University of Iowa Boiler MACT Compliance Stack Testing
Lisa Hanlon to: Scott Postma

02/08/2013 03:09 PM

Scott:
FYI. Let me know if this is something you really want to observe.
Lisa

Please note new address

Lisa Hanlon
EPA Region 7
11201 Renner Blvd.
Lenexa, KS 66219
913.551.7599
hanlon.lisa@epa.gov

----- Forwarded by Lisa Hanlon/R7/USEPA/US on 02/08/2013 03:06 PM -----

From: "Maxwell, Mark W" <mark-maxwell@uiowa.edu>
To: Lisa Hanlon/R7/USEPA/US@EPA
Cc: "dennis.thielen@dnr.iowa.gov" <dennis.thielen@dnr.iowa.gov>
Date: 02/08/2013 03:04 PM
Subject: University of Iowa Boiler MACT Compliance Stack Testing

Hello Lisa,

As I discussed with you on the phone, we are planning to do the Boiler MACT compliance testing for the Hurst biomass boiler (Permit # 78-A-023-S7) in March. This testing is currently scheduled for the week of March 24. March 25 will be the setup day with actual testing to follow on March 26 and 27. I have attached a protocol from Mostardi-Platt for the planned testing. Please let me know if you need additional information.

Thanks,

Mark Maxwell, P.E.
Environmental Engineer
University of Iowa Power Plant
319-335-6185



M131103.pdf

ATTACHMENT 4



Hurst Boiler Permit

Maxwell, Mark W

to:

Scott Postma

02/11/2013 12:56 PM

Hide Details

From: "Maxwell, Mark W" <mark-maxwell@uiowa.edu>

To: Scott Postma/R7/USEPA/US@EPA

2 Attachments



Hurst TriMer.pdf Oakdale Permits.pdf

Scott,

I have attached the permit for the Hurst Boiler and some additional information on the boiler and Tri-Mer filter.

Thanks,

Mark Maxwell, P.E.

Environmental Engineer

University of Iowa Power Plant

319-335-6185

Postma, Scott

From: Maxwell, Mark W [mark-maxwell@uiowa.edu]
Sent: Friday, March 08, 2013 11:10 AM
To: Postma, Scott
Cc: Fish, Ben P; Kottenstette, Stephen D
Subject: Tri-Mer UltraTemp Filtration
Attachments: hot-gas-filtration.pdf

Scott,

Here is an additional brochure on the Tri-Mer UltraTemp Filtration process. Please note that we do not do SO₂ or mercury control with our unit. Just PM and NO_x control. Our fuels contain negligible amounts of sulfur and mercury.

For Boiler MACT purposes, the boiler falls in the category of "Stokers/sloped grate/others designed to burn wet biomass." The unit is currently only burning wood chips, or natural gas. We will just be burning wood chips during the stack testing.

Setup will be on March 25 with the start of testing planned for March 26. I will let you know if there are any changes to the schedule.

Thanks,

Mark Maxwell, P.E.
Environmental Engineer
University of Iowa Power Plant
319-335-6185

Postma, Scott

From: Maxwell, Mark W [mark-maxwell@uiowa.edu]
Sent: Wednesday, April 03, 2013 1:08 PM
To: Hanlon, Lisa; Postma, Scott
Cc: 'dennis.thielen@dnr.iowa.gov'; Bigger, Anthony [DNR] (Anthony.Bigger@dnr.iowa.gov)
Subject: RE: University of Iowa Boiler MACT Compliance Stack Testing

Hello Ms. Hanlon,

As you are probably aware, the testing of the University of Iowa Hurst Boiler got delayed due to operational problems with the boiler. We would like to reschedule the testing for May 1 if that is acceptable to EPA. We will again use Mostardi-Platt and they will be setting up on April 30 and starting the testing on May 1. Let me know if this is not acceptable.

Thanks,

Mark Maxwell, P.E.
Environmental Engineer
University of Iowa Power Plant
319-335-6185

From: Maxwell, Mark W
Sent: Friday, February 08, 2013 3:04 PM
To: 'hanlon.lisa@epa.gov'
Cc: dennis.thielen@dnr.iowa.gov
Subject: University of Iowa Boiler MACT Compliance Stack Testing

Hello Lisa,

As I discussed with you on the phone, we are planning to do the Boiler MACT compliance testing for the Hurst biomass boiler (Permit # 78-A-023-S7) in March. This testing is currently scheduled for the week of March 24. March 25 will be the setup day with actual testing to follow on March 26 and 27. I have attached a protocol from Mostardi-Platt for the planned testing. Please let me know if you need additional information.

Thanks,

Mark Maxwell, P.E.
Environmental Engineer
University of Iowa Power Plant
319-335-6185

Postma, Scott

From: Maxwell, Mark W [mark-maxwell@uiowa.edu]
Sent: Thursday, May 02, 2013 3:21 PM
To: Postma, Scott
Cc: Hanlon, Lisa
Subject: Hurst Boiler Testing Problems

Hi Scott,

I haven't been able to get a definitive answer on why they couldn't make the boiler stay on-line yesterday for the testing. We had been running the boiler for several days prior to the planned testing date. There was either a problem with the wood fuel that we received for the stack test, or the way they operated the boiler. Whatever it was, they couldn't keep the boiler lit when we needed it to work for the stack test. We will be contacting the Hurst company, and possibly bringing them back on-site, to get their guidance on what is going wrong. We have people with a lot of experience running coal and natural gas boilers, but a 100% wood boiler is fairly new to us. I apologize for bringing you all the way up here again for another failure. We really thought things were going well earlier in the week. After we regroup, and have talked to the manufacturer, we will be trying to test again. The initial boiler MACT compliance date for this unit is July 31, and we are still planning to meet that. I will keep you informed of our schedule as this unfolds.

Again, my apologies,

Mark Maxwell, P.E.
Environmental Engineer
University of Iowa Power Plant
319-335-6185



Postma, Scott

From: Maxwell, Mark W [mark-maxwell@uiowa.edu]
Sent: Friday, June 21, 2013 3:42 PM
To: Hanlon, Lisa; Postma, Scott
Subject: RE: U of I Hurst Boiler Stack Testing update

Scott and Lisa,

I have the Hurst Boiler stack testing scheduled for the week of ~~July 22~~. Setup on Monday, testing on Tuesday and Wednesday. Mostardi-Platt of Elmhurst, IL. will be the testing company. The scope of the testing and the protocol will be identical to the one I submitted earlier. Of course I will let you know if anything changes between now and then.

Thanks,

Mark Maxwell, P.E.
Environmental Engineer
University of Iowa Power Plant
319-335-6185

From: Hanlon, Lisa [<mailto:Hanlon.Lisa@epa.gov>]
Sent: Tuesday, June 18, 2013 2:20 PM
To: Maxwell, Mark W; Postma, Scott
Subject: RE: U of I Hurst Boiler Stack Testing update

Mark:

Since IDNR has not had a chance to adopt the Boiler MACT yet, any noncompliance issues with it will go through EPA until it's adopted.

There isn't a mechanism under the MACT to grant variances, so any operation of the boiler after the compliance deadline without a successful test would be considered noncompliance with the rule. If the testing can't be successfully completed by the compliance deadline, one option we could consider a compliance order that would essentially put you on a schedule to conduct the test and continue to operate it. I don't want to get ahead of ourselves, so let's hope that the testing can be completed in time. In the meantime, keep in touch with your test schedule.

Lisa

Lisa Hanlon
U.S. EPA Region 7
Air Permitting and Compliance
11201 Renner Blvd.
Lenexa, KS 66219
913-551-7599
hanlon.lisa@epa.gov

From: Maxwell, Mark W [<mailto:mark-maxwell@uiowa.edu>]
Sent: Tuesday, June 18, 2013 10:22 AM
To: Postma, Scott
Cc: Hanlon, Lisa
Subject: RE: U of I Hurst Boiler Stack Testing update

Hi Scott,

I have a question about complying with Boiler MACT. If we are not able to complete the testing by the compliance date of July 30, what are our options for doing the compliance testing after that date? We would likely need to run the boiler at least a little, to get it ready for doing a compliance test. Would we need to request a variance to run the boiler enough to get it ready for a compliance test?

We are still trying to get Hurst in here to troubleshoot the boiler for us in the next few weeks. We would then try another stack test in the last few weeks of July. There is apparently some kind of snag between our purchasing department and theirs at this point. It has been more than a little frustrating but I am still confident we can get one more attempt in before the end of July.

Thanks,

Mark Maxwell, P.E.
Environmental Engineer
University of Iowa Power Plant
319-335-6185

From: Postma, Scott [<mailto:Postma.Scott@epa.gov>]
Sent: Wednesday, June 05, 2013 9:03 AM
To: Maxwell, Mark W
Cc: Hanlon, Lisa
Subject: RE: U of I Hurst Boiler Stack Testing update

Thanks for the update.

Scott Postma, QSTO 1, 2, 3
Region VII, EPA
300 Minnesota Ave.
Kansas City, KS 66101
(913) 551-7048

From: Maxwell, Mark W [<mailto:mark-maxwell@uiowa.edu>]
Sent: Wednesday, June 05, 2013 8:23 AM
To: Postma, Scott
Cc: Hanlon, Lisa
Subject: U of I Hurst Boiler Stack Testing update

Hi Scott,

I just wanted to give you a quick update. We are still trying to arrange for someone from Hurst to come in and troubleshoot our boiler problems. Our purchasing department is not making it easy to get them a PO. I am still hopeful we can get Hurst in here sometime in June, and then do stack testing in July, but I still do not have a date. I'll keep you informed.

Thanks,

Mark Maxwell, P.E.
Environmental Engineer
University of Iowa Power Plant
319-335-6185

ATTACHMENT 5



PROPOSAL #2009-12-30-400-150

BIOMASS FIRED STEAM PLANT

400 HORSEPOWER / 13,800 PPH / 150 PSIG DESIGN / 135 PSIG OPERATING

FOR

University of Iowa – Oakdale Campus

Iowa City, Iowa
USA

P. Ferman Milster, P.E.
Associate Director – Utilities & Energy Management
University of Iowa
230 University Services Building
Iowa City, Iowa 52242-1922
Phone: (319) 335-5132
Email: ferman-milster@uiowa.edu

Copies to :
edward-scherrer@uiowa.edu
ehendrickson@shive-hattery.com

December 30, 2009

by

Global Energy Solutions, Inc.—Representative for Hurst Boiler & Welding Co., Inc.



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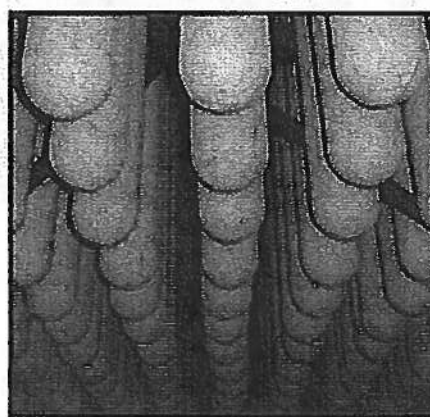
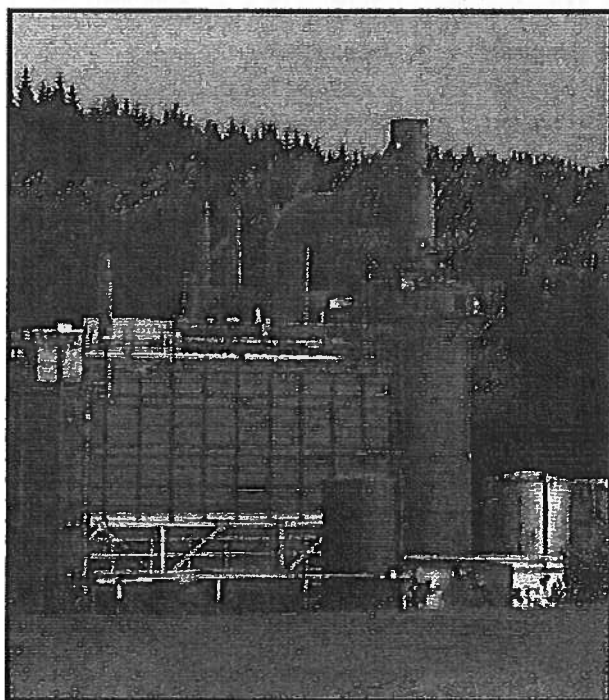
GENERAL SPECIFICATIONS

1. Scope of Equipment: One (1) substoichiometric wet biomass fuel gasifier, combustor and heat recovery system fed from metering bin.
2. Gasifier Fuel Requirements: 1-1/2" x 2-1/2" x 5/8" or less in size, 50% or less in moisture content and a BTU content of 4,347 BTU/lb (minimum).
3. Approximate Fuel Usage at Maximum Firing Rate: 400 BoHP = 3,245 lbs/hr & 18,342,400 BTU/Hr input @ 35% MC.
600 BoHP = 4,868 lbs/hr & 27,513,600 BTU/Hr input @ 35% MC.
4. Boiler Rating: 400 BoHP, 13,800 PPH steam output from and @ 212°F
600 BoHP, 20,700 PPH steam output from and @ 212 F
5. Boiler Pressure: 150 PSI design pressure.
Maximum recommended operating pressure is 135 PSI.
6. Boiler Design: Base: High Pressure HBC Hybrid,
Model #HY-2600-150 (400 BoHP)
Model #HY-3900-150 (600 BoHP)
Built in accordance with the ASME Code.

ULTRATEMP HOT GAS FILTRATION SYSTEMS

Ceramic Fiber Technology Facilitates Advancement in Hot Gas Filtration

Tri-Mer Corporation, a developer of advanced technologies for the control of VOCs, fine particulate and industrial gases, has introduced "UltraTemp Filtration," a hot gas filtration system that filters fine particulate to extremely low levels. It also offers exceptional performance with dry scrubbing sorbent injection for the removal of acid gases.



Ceramic filter elements in the UltraTemp Filtration system for hot gas filtration.

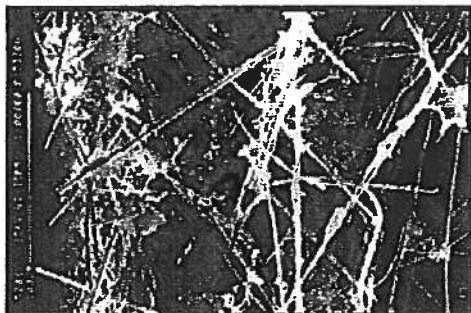
UltraTemp waste incinerator incorporating new ceramic filter elements. The cooling chamber is to the right of the filter plant.

The heart of the UltraTemp Hot Gas Filtration system is a new generation of ceramic filters. Earlier generations of ceramic filters – sometimes called "candle" filters – were manufactured from high-density granular powders similar to common ceramic products. While effective, they were brittle, with low thermal shock resistance, and were prone to cracking and breakage from thermal shock. Surface porosity also made cleaning of the filters difficult because of their tendency to "blind."

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CORPORATION
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Now, with recent advances in ceramic technology, these issues have been overcome. The filters used in the Tri-Mer UltraTemp Filtration system are manufactured from a new generation of low-density ceramic fibers that provide exceptionally high resistance to thermal shock. This makes the filters very ductile and resistant to crack formation.



Micrograph of filter elements composition.

CHARACTERISTICS OF (LOW-DENSITY) CERAMIC ELEMENTS	
Form	Monolithic rigid tube
Composition	Refractory fibers plus organic and inorganic binding agents
Porosity	About 80-90%
Density	About 0.3 - 0.4 g/cc
Support	Self supporting from integral flange
Geometry	Outer diameter up to 150 mm; Length up to 3 m

Characteristics of the fibrous ceramic filter elements.

Other unique properties of the fibers give the UltraTemp filters an exceptional ability to capture fine particulates at the surface, without blinding. They are thus easy to clean using standard pulse-jet techniques. Being fibrous, rather than granular, the filter elements are also lightweight, and have a low resistance to flow, which minimizes the number of elements required for a given application.

The UltraTemp Filtration system provides optimal filtration for gases between 400°F and 1000°F, and in most cases can be applied to hot gas streams up to a maximum operating temperature of 1650°F. Typical filtration results are 0.001 grain/dscf (2 mg/Nm³); many results are a fraction of this typical value.

CHARACTERISTICS OF HIGH- AND LOW-DENSITY CERAMIC-FILTER ELEMENTS		
	High Density	Low Density
Structure	Granular	Fibrous
Density	High	Low
Filter Drag	High	Low
Porosity, % (Inverse of resistance to flow)	0.3 - 0.4	0.8 - 0.9
Tensile strength	High	Low
Fracture mechanism	Brittle	Ductile
Thermal shock resistance	Low	High
Cost	High	Low

Contrast between types of ceramic filter elements.

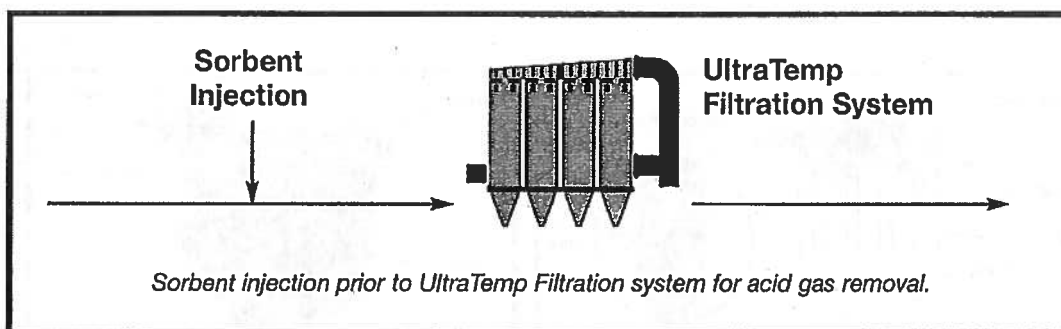
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UltraTemp Filtration is compatible with heavy loadings, often above 1 grain/dscf (2300 mg/Nm³). Certain applications involving three or four times this loading at the inlet still achieve outlet levels of less than 0.001 grains/dscf. The ceramic filters are almost completely chemically inert and highly corrosion-resistant.

Applications of the Tri-Mer UltraTemp Filtration system include syngas cleaning, glass production, waste incineration, and biomass pyrolysis. UltraTemp Filtration is also an excellent way to achieve ICI boiler MACT compliance for coal, biomass, and wood. Other applications include metal smelting, mineral processing and chemical production.

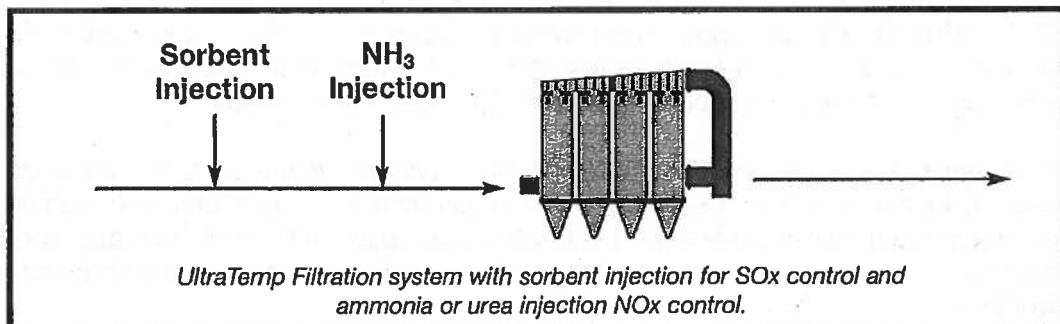
The Tri-Mer UltraTemp Filtration system features an option for dry injection of calcium or sodium-based sorbents for the capture of acid gases. Injected in the duct upstream of the filter modules, the additional sorbent particulate is easily captured along with its pollutant gas. For these applications, SO₂ removal is typically 80% or better, with removal efficiencies as high as 97%. HCl removal is typically 95%, and often as high as 99%.



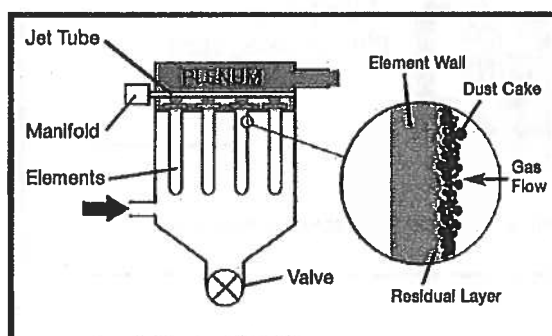
If the need is NO_x, VOC, or dioxin removal, UltraTemp filter elements are available with catalysts embedded in the filters themselves. Urea is then injected upstream of the filters. NO_x removal in these systems is typically above 90%. VOC oxidation and dioxin removal are also both exceptionally high. UltraTemp Filtration can incorporate both sorbent injection and catalyst reduction in a single system. Acid gases, such as SO₂, and NO_x can be simultaneously removed in the same system.

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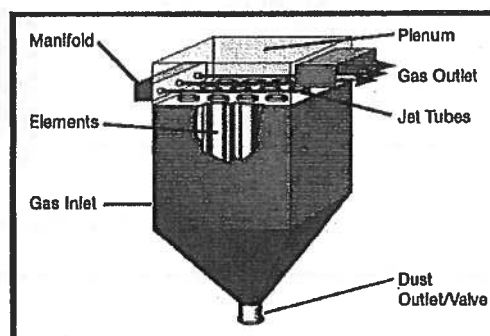
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Tri-Mer's UltraTemp Hot Gas Filtration system uses a baghouse configuration with a reverse pulse-jet cleaning action. The filters are back-flushed with air, inert gas, syngas, or other appropriate gases. It has a reliable sealing mechanism that is easy to access, and the design has been engineered for easy installation and maintenance. Filter elements are manufactured in various sizes, the largest of which is ten feet long and six inches in diameter, including an integral mounting flange.



Reverse pulse jet cleaning mechanism for the filter elements.



Filter element housing module of the Tri-Mer UltraTemp Filtration system.

The UltraTemp Filtration system is an efficient, proven alternative for hot gas filtration. With over 200 applications worldwide, it is now commercially available throughout the US, with full technical and start-up support.

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Selected Applications

- Syngas cleaning
- Glass production
- Waste incineration
- Waste pyrolysis
- Boiler MACT compliance for coal, biomass, wood
- Metal smelting, mineral processing
- Chemical production
- Many specialized high temperature applications

Tri-Mer Corporation, a technology leader in air pollution control, is the exclusive manufacturer of the UltraTemp Filtration system, and provides turnkey engineering, manufacturing, installation, and service through its Michigan facility.

***For more information, contact Kevin Moss,
Tri-Mer Business Development Director, Advanced Technologies.
Direct line: (801) 294-5422, or kevin.moss@tri-mer.com***



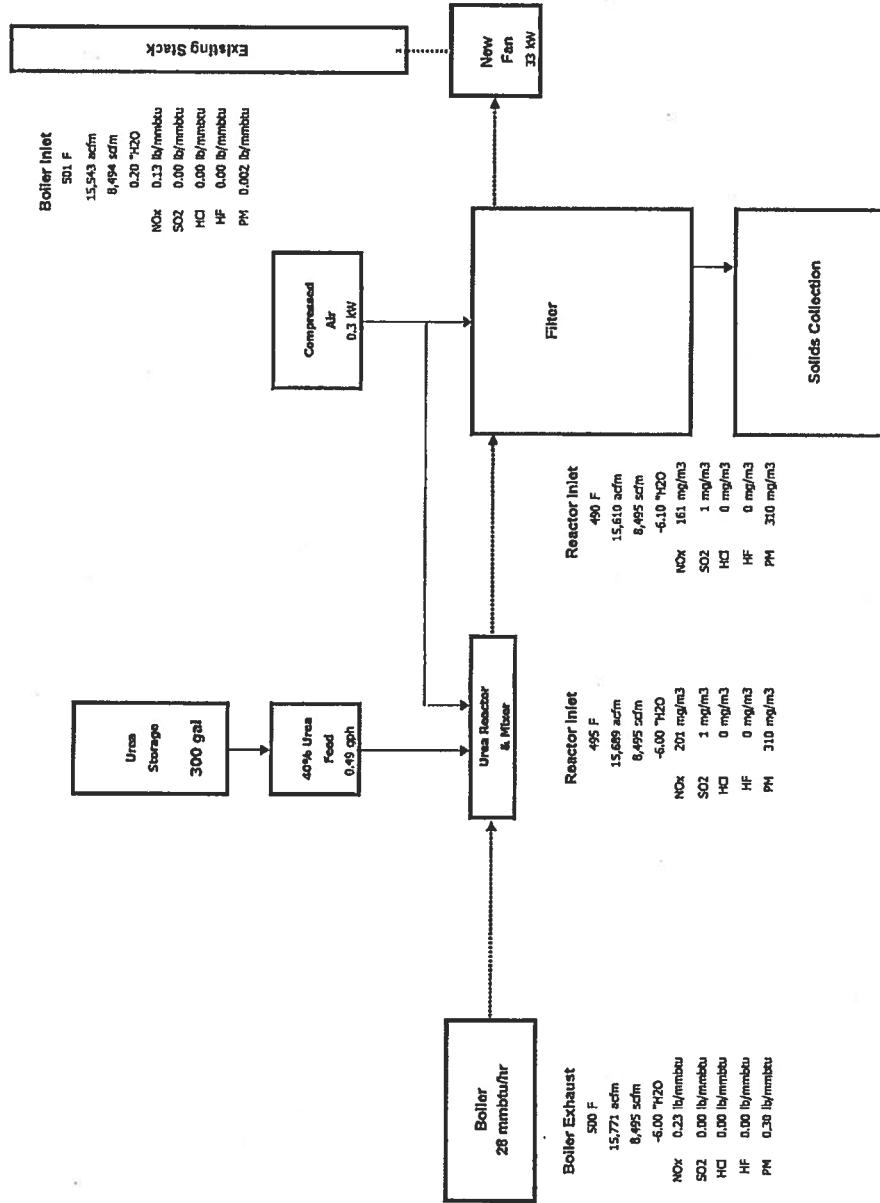
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University of Iowa
Process Flow Diagram
University of Iowa
Physical Plant
28 mmmbtu/hr

Air Flow, induced draft
Liquid Flow, pressurized
Liquid Flow, gravity

Utility Summary
Power 730 kW
Urea 0.5 gph



1400 E. Monroe Street Owosso, MI 48867
ph (989) 723-7844 fax (989) 723-7844
www.tri-mer.com



ATTACHMENT 6

MULTI METHOD NON-ISOKINETIC FIELD DATA SHEET

Project Name/Number: M133003

Date: 7/23/13

Test Location: Univ. of London

Source Condition:

Test Method: m 26

Meter ID: M13A

Pre-Calibration Date: 6/19/13

Meter ΔH :

Meter Y: 1.009

Test Engineer: AD

Test (Run) No. <u>5</u>		Barometric Pressure (P_{bar}) <u>29.5</u> in. Hg		Gas Sample Analysis	
Static Pressure: <u>-0.1</u>		Stack Temperature: <u>365</u> (From Method <u> </u> Test Data)		%CO ₂ <u> </u> %O ₂ <u> </u>	

Clock Time	Meter Volume (V_m) ft ³ or <u>(L)</u> (Circle One)	Meter Gage Pressure (ΔH) in. H ₂ O	Meter Inlet Temp. (t_m) °F	Meter Outlet Temp. (t_m) °F	Impinger Outlet Temp °F	Meter Vacuum "Hg	
14:55	00.00	0	92			0	<div style="display: flex; justify-content: space-between;"> <div> <u> </u> mls (V_i) <u> </u> mls (V_i) <u> </u> mls gained </div> <div> <u> </u> grams (W_i) <u> </u> grams (W_i) <u> </u> grams gained </div> </div>
15:00	10.163	2.0	92			-2.5	
15:05	20.135	2.0	92			-2.5	
15:10	30.075	2.0	92			-2.5	
15:15	40.256	2.0	92			-2.5	
15:20	50.145	2.0	92			-3	
15:25	60.045	2.0	92			-3	
15:30	70.383	2.0	92			-3	
15:35	80.412	2.0	92			-3	
15:40	90.054	2.0	92			-3	
15:45	100.270	2.0	92			-3	
15:50	110.567	2.0	92			-3	
15:55	120.248		92				
Total Vol. in ft ³ (V_m)= <u>4.247</u>		Multiply total volume collected in Liters by 0.035315 to convert to ft ³					<div style="text-align: right;"> <u>92</u> Average Meter Temperature: <u> </u> (average of both inlet and outlet if applicable) </div>

Comments:

Pre-Test Leak Check:

Post-Test Leak Check:

OK @ 10 "Hg

OK @ 10 "Hg

Test (Run) No. _____		Barometric Pressure (P_{bar}) _____ in. Hg			Gas Sample Analysis _____ %CO ₂ _____ %O ₂	
Static Pressure: _____		Stack Temperature: _____ (From Method _____ Test Data)				
Clock Time 24 hour	Meter Volume (V_m) ft³ or L (Circle One)	Meter Gage Pressure (ΔH) in. H ₂ O	Meter Inlet Temp. (t_m) °F	Meter Outlet Temp. (t_m) °F	Impinger Outlet Temp °F	Meter Vacuum "Hg
Total Vol. in ft ³ (V_m)=	Multiply total volume collected in Liters by 0.035315 to convert to ft ³					
Comments:				Pre-Test Leak Check: _____ @ _____ "Hg		Post-Test Leak Check: _____ @ _____ "Hg

Comments:

Pre-Test Leak Check:

Post-Test Leak Check:

@_____ "Hg

@_____ "Hg

MOSTARDI PLATT

IMPINGER WEIGHT SHEET

PLANT: UNIVERSITY

UNIT NO: HURST BOILER

LOCATION: EXHAUST DUCT

DATE: 7/23/13

TEST NO: 3

METHOD: 5/202

WEIGHED/MEASURED BY: JFR

BALANCE ID: S10-36

	FINAL WEIGHT	INITIAL WEIGHT	IMPINGER	IMPINGER
Circle One:	MLS / GRAMS	MLS / GRAMS	GAIN	CONTENTS
IMPINGER 1	857.6	535.8		BLANK
IMPINGER 2	594.6	586.7		BLANK
IMPINGER 3	693.7	692.4		D1 H2O
IMPINGER 4	833.7	813.4		SILICA
IMPINGER 5				
IMPINGER 6				
IMPINGER 7				
IMPINGER 8				

IMPINGERS 2145.9 1814.9 331.0
FINAL TOTAL INITIAL TOTAL TOTAL IMPINGER GAIN

SILICA 833.7 813.4 20.3
FINAL TOTAL INITIAL TOTAL TOTAL SILICA GAIN

1424

1226

MOSTARDI PLATT

IMPINGER WEIGHT SHEET

PLANT: UNIVERSITY OF IOWA

UNIT NO: HURST BOILER

LOCATION: EXHAUST BOILER

DATE: 7/23/13

TEST NO: 2

METHOD: 5/202

WEIGHED/MEASURED BY: JFR

BALANCE ID: 510-36

	FINAL WEIGHT	INITIAL WEIGHT	IMPINGER	IMPINGER
Circle One:	MLS / GRAMS	MLS / GRAMS	GAIN	CONTENTS
IMPINGER 1	816.3	587.9		BLANK
IMPINGER 2	653.1	652.0		BLANK
IMPINGER 3	689.1	689.5		D1 H2O
IMPINGER 4	837.4	820.5	820.5	SILICA
IMPINGER 5				
IMPINGER 6				
IMPINGER 7				
IMPINGER 8				

853.4

IMPINGERS 2158.5 1929.4 229.1
FINAL TOTAL INITIAL TOTAL TOTAL IMPINGER GAIN

SILICA 837.4 820.5 16.9
FINAL TOTAL INITIAL TOTAL TOTAL SILICA GAIN

818

924

Isokinetic Sampling Cover Sheet

Test Engineer: DT
Test Technician: AD

Plant Information

Run Number: 3 Date: 7/23/13 Project Number: M133003
Test Location: Boiler Outlet Duct Client Name: UNIVERSITY OF IOWA Plant Name: HURST BOILER PLANT
Duct Shape: Circular or Rectangular Length: Width: or Diameter:
Flue Area: 19250 Upstream Diameters: Downstream Diameters:
Port Type: FLANGE Port Length: 6" Port Diameter: 6"
Test Method: 5/202 Source Condition:

Meter and Probe Data

Meter ID: CM6 Meter Y Value: 1 ΔH Value: 1
Pitot ID: 203 Pitot Coefficient: 0.840 Train Type: HOT BOX
Nozzle Kit ID: 55 #1 Nozzle Diameter: 1495 Filter Number/Weight: 6101 / 0.4626
Probe Length: 4' Probe Liner: CLAS 5 Thimble Number/Weight:
Pre-Test Nozzle Leak Check: 0.005 @ 10 "Hg Post-Test Nozzle Leak Check: @ "Hg
Pre-Test Pitot Leak Check: 0.5 , 2 "H₂O Post-Test Pitot Leak Check: "H₂O

Traverse Data

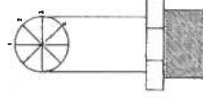
Ports Sampled: 5 Points/Port: 5 Min/Point: 5
Total Points: 25 Total Test Time: 125 Sample Plane: Horizontal or Vertical

Stack Parameters

Barometric Pressure: 29.3 Static Pressure: -1 Determined by: Method 3 or Method 3A
CO₂ %: 1 / Avg. 10.9 O₂ %: 1 / Avg. 10.3 Servomex Serial #: 0144021 / 4446
Imp and/or silica balance Model and S/N: 510-36 Final Imp. Volume or Weight: 2145.9 Imp. Volume or Weight Gain: 331.0
Initial Imp. Volume or Weight: 1814.9 Final Silica Weight: 833.7 Silica Weight Gain: 20.3
Initial Silica Weight: 813.4

Comments:

Post-Test Nozzle Verification:



1) 2) 3) 4)

MULTI METHOD NON-ISOKINETIC FIELD DATA SHEET

Project Name/Number: M133003 Date: 7/23/13
 Test Location: Univ. of Iowa Source Condition: _____
 Test Method: M26 Meter ID: M13A Pre-Calibration Date: 6/19/13
 Meter ΔH: _____ Meter Y: 1.009 Test Engineer: AD

Test (Run) No. <u>1</u>		Barometric Pressure (P _{bar}) <u>27.5</u> in. Hg		Gas Sample Analysis		
Static Pressure: <u>-0.1</u>		Stack Temperature: <u>360</u> (From Method _____ Test Data)		_____ %CO ₂ _____ %O ₂		
Clock Time	Meter Volume (V _m) ft ³ or L (Circle One)	Meter Gage Pressure (ΔH) in. H ₂ O	Meter Inlet Temp. (t _m) °F	Meter Outlet Temp. (t _m) °F	Impinger Outlet Temp °F	Meter Vacuum "Hg
12:05	00.00	0	89			0
12:10	10.103	2.0	89			-2
12:15	20.406	2.0	89			-2
12:20	30.186	2.0	89			-2
12:25	40.153	2.0	90			-2
12:30	50.417	2.0	90			-3
12:35	60.395	2.0	90			-3
12:40	70.159	2.0	90			-3
12:45	80.290	2.0	90			-2
12:50	90.315	2.0	91			-2
12:55	100.189	2.0	91			-3
13:00	110.358	2.0	91			-3
13:05	120.406	2.0	91			-3
Total Vol. in ft ³ (V _m)= <u>4.252</u> Multiply total volume collected in Liters by 0.035315 to convert to ft ³						

Condensate

Silica Gel or Train

_____ mls (V_i) _____ grams (W_i)
 - _____ mls (V_i) - _____ grams (W_i)
 = _____ mls gained = _____ grams gained

Average Meter Temperature: 90
 (average of both inlet and outlet if applicable)

Comments:	Pre-Test Leak Check: <u>OK @ 10</u> "Hg	Post-Test Leak Check: <u>OK @ 10</u> "Hg
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Test (Run) No. <u>2</u>		Barometric Pressure (P _{bar}) <u>27.5</u> in. Hg		Gas Sample Analysis		
Static Pressure: <u>-0.1</u>		Stack Temperature: <u>360</u> (From Method _____ Test Data)		_____ %CO ₂ _____ %O ₂		
Clock Time	Meter Volume (V _m) ft ³ or L (Circle One)	Meter Gage Pressure (ΔH) in. H ₂ O	Meter Inlet Temp. (t _m) °F	Meter Outlet Temp. (t _m) °F	Impinger Outlet Temp °F	Meter Vacuum "Hg
13:35	00.00	0	91			0
13:40	10.267	2.0	91			-2
13:45	20.335	2.0	91			-2
13:50	30.185	2.0	91			-2
13:55	40.143	2.0	92			-3
14:00	50.210	2.0	92			-3
14:05	60.257	2.0	92			-3
14:10	70.184	2.0	92			-3
14:15	80.248	2.0	92			-3
14:20	90.153	2.0	92			-3
14:25	100.018	2.0	92			-3
14:30	110.045	2.0	92			-3
14:35	120.413	2.0	92			-3
Total Vol. in ft ³ (V _m)= <u>4.252</u> Multiply total volume collected in Liters by 0.035315 to convert to ft ³						

Condensate

Silica Gel or Train

_____ mls (V_i) _____ grams (W_i)
 - _____ mls (V_i) - _____ grams (W_i)
 = _____ mls gained = _____ grams gained

Average Meter Temperature: 91.69
 (average of both inlet and outlet if applicable)

Comments:	Pre-Test Leak Check: <u>OK @ 10</u> "Hg	Post-Test Leak Check: <u>OK @ 10</u> "Hg
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Isokinetic Sampling Cover Sheet

Test Engineer: DT

Test Technician: AD

Plant Information

Run Number: 1 Date: 7/23/13 Project Number: M133003
 Test Location: Boiler Outlet Duct Client Name: UNIVERSITY OF SOUTHERN CALIFORNIA Plant Name: HURST BOILER PLANT
 Duct Shape: Circular or Rectangular Length: 5.5 Width: 3.5 or Diameter: _____
 Flue Area: 19.250 Upstream Diameters: _____ Downstream Diameters: _____
 Port Type: FLANGE Port Length: 6 Port Diameter: 6
 Test Method: 5/202 Source Condition: _____

Meter and Probe Data

Meter ID: CM6 Meter Y Value: 1' ΔH Value: 1'
 Pitot ID: 203 Pitot Coefficient: 1.840 Train Type: Hot Box
 Nozzle Kit ID: SS Nozzle Diameter: .495 Filter Number/Weight: 6093
 Probe Length: 4' Probe Liner: 64SS Thimble Number/Weight: _____
 Pre-Test Nozzle Leak Check: 0.000 @ 10 "Hg Post-Test Nozzle Leak Check: .006 @ 5 "Hg
 Pre-Test Pitot Leak Check: 0.0 @ 2 "H₂O Post-Test Pitot Leak Check: 0.0 @ 2 "H₂O

Traverse Data

Ports Sampled: 5 Points/Port: 5 Min/Point: 6
 Total Points: 25 Total Test Time: 150 min Sample Plane: Horizontal or Vertical

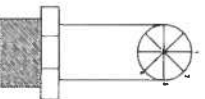
Stack Parameters

Barometric Pressure: 29.3 Static Pressure: -1'
 CO₂ %: 1 / 1 Avg. 10.9 O₂ %: 1 / 1 Avg. 9.8 Determined by: Method 3 or Method 3A
 Imp and/or silica balance Model and S/N: 510-36 Servomex Serial #: 0194001/4446
 Initial Imp. Volume or Weight: 1937.5 Final Imp. Volume or Weight: 2205.4 Imp. Volume or Weight Gain: 267.9
 Initial Silica Weight: 823.8 Final Silica Weight: 844.3 Silica Weight Gain: 20.5

Comments:

Post-Test Nozzle Verification:

1) _____ 2) _____ 3) _____ 4) _____



Isokinetic Sampling Field Data Sheet-M202

Project Number: M133003 Date: 7/23/13 Test Number: 1
 Client: UNIVERSITY OF IOWA Test Location: BOILER OUTLET DUCT Operator: D7 Test Tech: AD
 Plant: HURST BOILER PLANT Test Method: 5 1202 Page Number: 1 of 2

Port-Point #.	Time	(AP)	Orifice Setting (ΔH)	Meter Volume (V _m) ft ³ , Actual	Square Root, AP	Meter Rate, Cubic Feet/Min.	Theoretical Meter Volume, (V _m) ft ³ , per point	Theoretical Meter Volume, (V _m) ft ³ , total	Stack Temp, °F	Meter Temp Inlet, °F	Meter Temp Outlet, °F	Pump Vacuum, " Hg	Probe Temp. °F	Filter Temp. °F	CPM Filter Temp. °F	Impinger Outlet Well Temp °F
1-1	1205	.015	0.4	371.873	.122	.403	1.209	373.082	379	89	88	1	254	251	85	67
-1	1208	.015	0.4	373.10	.122	.403	1.209	374.291	379	89	88	1	254	251	85	65
-2	1211	.015	0.4	374.132	.122	.403	1.209	374.291	378	90	89	1	253	250	85	65
-2	1214	.015	0.4	375.51	.122	.403	1.209	375.800	378	90	89	1	253	251	85	64
-3	1217	.015	0.4	376.72	.122	.403	1.209	376.109	377	91	89	1	252	253	85	63
-3	1220	.015	0.4	377.93	.122	.403	1.209	377.918	377	91	89	1	250	251	85	63
-4	1223	.01	0.3	377.14	.100	.329	.987	379.127	373	92	89	1	253	251	85	61
-4	1226	.01	0.3	380.22	.100	.329	.987	380.114	373	92	89	1	252	251	85	61
-5	1229	.01	0.3	381.10	.100	.329	.987	381.101	372	92	89	1	251	251	84	59
-5	1232	.01	0.3	382.26	.100	.329	.987	382.088	372	92	89	1	250	252	84	59
	1235			383.490				383.075								
2-1	1240	.025	0.7	383.490	.158	.520	1.561	385.051	368	92	90	1	252	251	85	55
-1	1243	.025	0.7	385.08	.158	.520	1.561	385.051	368	92	90	1	253	250	85	55
-2	1246	.02	0.55	386.65	.141	.465	1.396	386.612	369	94	90	1	254	251	82	54
-2	1249	.02	0.55	388.12	.141	.465	1.396	388.008	364	94	90	1	253	251	82	54
-3	1252	.015	0.4	389.41	.122	.403	1.209	389.404	365	94	91	1	253	251	80	54
-3	1255	.015	0.4	390.61	.122	.403	1.209	390.613	365	94	91	1	252	251	80	54
-4	1258	.015	0.4	391.83	.122	.403	1.209	391.822	366	94	91	1	252	251	80	54
-4	1301	.015	0.4	393.05	.122	.403	1.209	393.031	366	94	91	1	253	250	80	54
-5	1304	0.01	0.3	394.26	.100	.329	.987	394.240	367	94	91	1	253	251	81	54
-5	1307	0.01	0.3	395.24	.100	.329	.987	395.227	367	94	91	1	253	251	81	54
	1310			396.658				396.214								
3-1	1315	.03	0.8	396.658	.173	.575	1.726	398.384	363	94	91	1	253	251	81	52
-1	1318	.03	0.8	398.40	.173	.575	1.726	398.384	363	94	91	1	253	250	81	52
-2	1321	.03	0.8	400.13	.173	.575	1.726	400.110	362	94	91	1	253	252	80	52
-2	1324	.03	0.8	401.84	.173	.575	1.726	401.836	362	94	91	1	252	252	80	52
-3	1327	.03	0.8	403.60	.173	.575	1.726	403.562	365	95	91	1	254	250	78	53
-3	1336	.03	0.8	405.30	.173	.575	1.726	405.288	365	95	91	1	253	251	78	53

Isokinetic Sampling Field Data Sheet-M202

Project Number: M133003 Date: 7/23/13 Test Number: 1
 Client: UNIVERSITY OF IOWA Test Location: ROKER OUTLET DUCT Operator: DT Test Tech: AD
 Plant: HURST ROCKER PLANT Test Method: S1202 Page Number: 2 of 2

Port- Point #.	Time	(AP)	Orifice Setting (ΔH)	Meter Volume (V _m) ft ³ , Actual	Square Root, AP	Meter Rate, Cubic Feet/ Min.	Theoretical Meter Volume, (V _m) ft ³ , per point	Theoretical Meter Volume, (V _m) ft ³ , total	Stack Temp, °F	Meter Temp Inlet, °F	Meter Temp Outlet, °F	Pump Vacuum, " Hg	Probe Temp. °F	Filter Temp. °F	CPM Filter Temp. °F	Impinger Outlet Temp °F
3-4	1333	.02	0.6	407.14	.141	.470	1.409	407.014	345	95	92	2	253	251	78	54
-4	1336	.02	0.6	408.42	.141	.470	1.409	408.423	345	95	92	2	253	252	78	54
-5	1339	.015	0.4	409.84	.122	.407	1.220	409.832	347	95	92	2	252	251	78	54
-5	1342	.015	0.4	411.07	.122	.407	1.220	411.052	347	95	92	2	252	251	78	54
	1345			412.510				412.272								
4-1	1353	.035	1.0	412.510	.187	.621	1.863		361	73	72	4	253	251	82	55
-1	1356	.035	1.0	414.39	.187	.621	1.863	414.374	361	93	92	4	252	250	82	55
-2	1359	.035	1.0	416.25	.187	.621	1.863	416.237	364	94	92	4	253	251	80	55
-2	1402	.035	1.0	418.13	.187	.621	1.863	418.100	364	94	92	4	254	251	80	55
-3	1405	.04	1.1	419.97	.200	.664	1.993	419.963	364	96	92	4	253	250	78	58
-3	1408	.04	1.1	421.96	.200	.664	1.993	421.956	364	96	92	4	252	252	78	58
-4	1411	.03	0.8	423.98	.173	.575	1.726	423.949	357	96	92	3	253	252	78	59
-4	1414	.03	0.8	425.69	.173	.575	1.726	425.675	357	96	92	3	252	252	78	59
-5	1417	.03	0.8	427.43	.173	.575	1.726	427.401	357	96	92	3	253	251	78	60
-5	1420	.03	0.8	429.15	.173	.575	1.726	429.127	359	96	92	3	251	250	78	60
	1423			430.865				430.853								
5-1	1431	.025	0.7	430.965	.158	.535	1.605		323	94	92	3	253	251	83	61
-1	1434	.025	0.7	432.59	.158	.535	1.605	432.570	323	94	92	3	252	251	83	61
-2	1437	.025	0.7	434.20	.158	.535	1.605	434.175	323	95	92	3	252	251	81	58
-2	1440	.025	0.7	435.80	.158	.535	1.605	435.780	323	95	92	3	252	251	81	58
-3	1443	.02	0.6	437.39	.141	.478	1.435	437.385	321	95	92	2	253	251	80	58
-3	1446	.02	0.6	438.83	.141	.478	1.435	438.820	321	95	92	2	252	251	80	58
-4	1449	.025	0.7	440.26	.141	.478	1.605	440.255	354	95	92	2	252	251	79	58
-4	1452	.025	0.7	441.88	.141	.478	1.605	441.860	354	95	92	2	252	251	79	58
-5	1455	.03	0.9	443.47	.173	.586	1.758	443.465	365	95	92	3	253	251	79	58
-5	1458	.03	0.9	445.22	.173	.586	1.758	445.223	365	95	92	3	254	252	79	58
	1501			447.021				446.981								

MOSTARDI PLATT

IMPINGER WEIGHT SHEET

PLANT: UNIVERSITY OF IOWA
 UNIT NO: HURST BOILER
 LOCATION: EXHAUST DUCT
 DATE: 7/23/13
 TEST NO: 1
 METHOD: 5/202
 WEIGHED/MEASURED BY: JFR
 BALANCE ID: 510-36

Circle One:	FINAL WEIGHT	INITIAL WEIGHT	IMPINGER	GAIN	CONTENTS
IMPINGER 1	643.8	590.9			BLANK
IMPINGER 2	650.5	651.1			BLANK
IMPINGER 3	691.4	695.5			D1H20
IMPINGER 4	844.3	823.8			SILICA
IMPINGER 5					
IMPINGER 6					
IMPINGER 7					
IMPINGER 8					

IMPINGERS
 FINAL TOTAL 2205.7
 INITIAL TOTAL 1937.5
 TOTAL IMPINGER GAIN 267.9

SILICA
 FINAL TOTAL 844.3
 INITIAL TOTAL 823.8
 TOTAL SILICA GAIN 20.5

Isokinetic Sampling Cover Sheet

Test Engineer: DT

Test Technician: AD

Plant Information

Run Number: 2 Date: 7/23/13 Project Number: M133003
 Test Location: Boiler 7 duct Client Name: UNIVERSITY OF IOWA Plant Name: HVAC BOILER PLANT
 Duct Shape: Circular or Rectangular Length: _____ Width: _____ or Diameter: _____
 Flue Area: 19,250 Upstream Diameters: _____ Downstream Diameters: _____
 Port Type: FLANGE Port Length: 6" Port Diameter: 6"
 Test Method: _____ Source Condition: _____

Meter and Probe Data

Meter ID: C46 Meter Y Value: _____ AH Value: _____
 Pilot ID: 203 Pilot Coefficient: .840 Train Type: HOT BOX
 Nozzle Kit ID: 55 #7 Nozzle Diameter: .498 Filter Number/Weight: 60921
 Probe Length: 4' Probe Liner: GLASS Thimble Number/Weight: _____
 Pre-Test Nozzle Leak Check: 0.008 @ 10 "Hg Post-Test Nozzle Leak Check: 0.003 @ 5 "Hg
 Pre-Test Pilot Leak Check: OK @ 2 "H₂O Post-Test Pilot Leak Check: OK @ 2 "H₂O

Traverse Data

Ports Sampled: 5 Points/Port: 5 Min/Point: 5
 Total Points: 25 Total Test Time: 125 min Sample Plane: Horizontal or Vertical

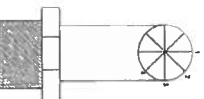
Stack Parameters

Barometric Pressure: 29.3 Static Pressure: -.1
 CO₂ %: 1 Avg. 10.2 O₂ %: 1 Avg. 10.5 Determined by: Method 3 or Method 3A
 Imp and/or silica balance Model and S/N: 510-36 Servomex Serial #: 0144001/4446
 Initial Imp. Volume or Weight: 1929.4 Final Imp. Volume or Weight: 2158.5 Imp. Volume or Weight Gain: 229.1
 Initial Silica Weight: 820.5 Final Silica Weight: 837.4 Silica Weight Gain: 16.9

Comments:

Post-Test Nozzle Verification:

1) _____ 2) _____ 3) _____ 4) _____



Isokinetic Sampling Field Data Sheet-M202

Project Number: M133003 Date: 7/23/13 Test Number: 2
 Client: UNIVERSITY OF LOWA Test Location: BOLLER OUTLET DET Operator: OT Test Tech: AD
 Plant: HUAS7 BOLLER PLANT Test Method: S 1202 Page Number: 1 of 2

Port- Point #.	Time	(ΔP)	Orifice Setting (ΔH)	Meter Volume (V _m) ft ³ , Actual	Square Root, ΔP	Meter Rate, Cubic Feet/ Min.	Theoretical Meter Volume, (V _m) ft ³ , per point	Theoretical Meter Volume, (V _m) ft ³ , total	Stack Temp, °F	Meter Temp Inlet, °F	Meter Temp Outlet, °F	Pump Vacuum, " Hg	Probe Temp. °F	Filter Temp. °F	CPM Filter Temp. °F	Impinger Outlet Well Temp °F
1-1	1630	.02	0.55	450.145	.141	465	1.395	451.540	392	91	91	2	251	249	85	67
	1633			451.590												
-1	1700	.015	0.41	451.590	.122	403	1.208	452.798	374	92	92	2	253	250	85	64
-2	1703	.015	0.41	452.80	.122	403	1.208	452.798	376	93	92	2	253	251	84	65
-2	1706	.015	0.41	454.12	.122	403	1.208	454.006	376	93	92	2	252	251	83	62
-3	1709	.010	0.3	455.37	.100	329	0.986	455.214	361	93	92	1	253	250	82	62
-3	1712	.010	0.3	456.21	.100	329	0.986	456.200	361	93	92	1	253	250	82	63
-4	1715	.010	0.3	457.30	.100	329	0.986	457.186	369	93	92	1	253	250	80	62
-4	1718	.010	0.3	458.37	.100	329	0.986	458.172	369	93	92	1	252	251	80	62
-5	1721	.010	0.3	459.19	.100	329	0.986	459.158	369	93	92	1	251	251	79	61
5	1724	.010	0.3	460.15	.100	329	0.986	460.144	369	93	92	1	253	250	79	61
	1727			461.168				461.13								
2-1	1733	.02	0.55	461.168	.141	465	1.395	462.563	370	93	92	2	253	251	81	66
-1	1736	.02	0.55	462.61	.141	465	1.395	462.563	370	93	92	2	252	250	81	66
-2	1739	.02	0.55	463.97	.141	465	1.395	463.758	373	94	92	2	252	251	77	59
-2	1742	.02	0.55	465.38	.141	465	1.395	465.353	373	94	92	2	253	251	77	59
-3	1745	.02	0.55	466.75	.141	465	1.395	466.748	369	95	92	2	254	250	76	59
-3	1748	.02	0.55	468.18	.141	465	1.395	468.143	369	95	92	2	253	251	76	59
-4	1751	.015	0.41	469.54	.122	403	1.208	469.538	367	95	92	2	252	251	76	60
-4	1754	.015	0.41	470.75	.122	403	1.208	470.746	367	95	92	2	253	251	76	60
-5	1757	.01	0.3	471.96	.100	329	0.986	471.954	366	95	93	1	254	250	77	65
-5	1800	.01	0.3	472.95	.100	329	0.986	472.940	366	95	93	1	252	251	77	65
	1803			474.030				473.926								
3-1	1808	.025	0.7	474.030	.158	526	1.578		366	94	93	3	253	250	80	64
-1	1811	.025	0.7	475.62	.158	526	1.578	475.608	366	94	93	3	252	251	80	64
-2	1814	.025	0.7	477.20	.158	526	1.578	477.186	365	95	93	3	254	251	73	55
-2	1817	.025	0.7	478.76	.158	526	1.578	478.764	365	95	93	3	253	250	73	55
-3	1820	.025	0.7	480.35	.158	526	1.578	480.342	367	96	93	3	252	251	70	54

Isokinetic Sampling Field Data Sheet-M202

Project Number: 4133003 Date: 7/23/13 Test Number: 2
 Client: UNIVERSITY OF IOWA Test Location: GOLDEROUTLET DUCT Operator: D7 Test Tech: AD
 Plant: HURST ADVEN AKANT Test Method: 5 1202 Page Number: 2 of 2

Port- Point #.	Time	(AP)	Orifice Setting (ΔH)	Meter Volume (V _m) ft ³ , Actual	Square Root, AP	Meter Rate, Cubic Feet/ Min.	Theoretical Meter Volume, (V _m) ft ³ , per point	Theoretical Meter Volume, (V _m) ft ³ , total	Stack Temp, °F	Meter Temp Inlet, °F	Meter Temp Outlet, °F	Pump Vacuum, " Hg	Probe Temp. °F	Filter Temp. °F	CPM Filter Temp. °F	Impinger Outlet Well Temp °F
3-3	1823	.025	0.7	481.93	.158	.526	1.578	481.920	367	96	93	3	251	252	70	54
-4	1826	.015	0.42	483.50	.122	.467	1.222	483.498	362	96	93	2	251	253	70	55
-4	1829	.015	0.42	484.73	.122	.467	1.222	484.720	362	96	93	2	252	253	70	55
-5	1832	.010	0.3	485.96	.100	.333	.998	485.942	360	96	94	1	253	252	75	60
-5	1835	.010	0.3	486.97	.100	.333	.998	486.940	360	96	94	1	252	251	75	60
	1838			488.085				487.938								
4-1	1845	.03	0.83	488.085	.173	.576	1.729	487.814	366	94	93	3	252	251	77	62
-1	1848	.03	0.83	489.82	.173	.576	1.729	487.814	366	94	93	3	253	252	77	62
-2	1851	.03	0.83	491.60	.173	.576	1.729	491.543	366	96	93	3	254	251	70	54
-2	1854	.03	0.83	493.28	.173	.576	1.729	493.212	366	96	93	3	252	250	70	54
-3	1857	.035	0.97	495.17	.181	.622	1.867	495.001	364	96	93	4	253	251	68	54
-3	1900	.035	0.97	496.88	.181	.622	1.867	496.868	364	96	93	4	252	252	68	54
-4	1903	.035	0.97	498.74	.187	.622	1.867	498.735	366	97	94	4	252	253	68	55
-4	1906	.035	0.97	500.63	.187	.622	1.867	500.602	366	97	94	4	251	252	68	55
-5	1909	.03	0.83	502.47	.173	.576	1.729	502.465	361	97	94	3	253	250	69	55
-5	1912	.03	0.83	504.20	.173	.576	1.729	504.198	361	97	94	3	252	251	69	55
	1915			506.065				505.927								
5-1	1924	.02	.58	506.065	.141	.481	1.442	507.507	317	95	94	2	252	250	74	61
-1	1927	.02	.58	507.51	.141	.481	1.442	507.507	317	95	94	2	253	251	74	61
-2	1930	.02	.58	508.99	.141	.481	1.442	508.949	312	96	94	2	252	250	74	61
-2	1933	.02	.58	510.42	.141	.481	1.442	510.391	312	96	94	2	252	250	74	61
-3	1936	.02	.58	511.85	.141	.481	1.442	511.833	332	96	94	2	254	250	74	62
-3	1939	.02	.58	513.27	.141	.481	1.442	513.275	332	96	94	2	253	252	74	62
-4	1942	.02	.58	514.71	.141	.481	1.442	514.717	335	96	94	2	252	251	74	64
-4	1945	.02	.58	516.20	.141	.481	1.442	516.159	335	96	94	2	253	250	74	64
-5	1948	.015	.44	517.63	.122	.416	1.1249	517.601	334	96	94	2	254	251	75	66
-5	1951	.015	.44	518.88	.122	.416	1.1249	518.850	334	96	94	2	253	251	75	66
	1954			520.235				520.099								

Isokinetic Sampling Field Data Sheet-M202

Project Number: M133003 Date: 7/23/13 Test Number: 3
 Client: UNIVERSITY OF IOWA Test Location: BOILER OUTLET DUCT Operator: AD Test Tech: AD
 Plant: HURST BOILER PLANT Test Method: 5 1202 Page Number: 1 of 2

Port-Point #.	Time	(ΔP)	Orifice Setting (ΔH)	Meter Volume (V _m) ft ³ , Actual	Square Root, ΔP	Meter Rate, Cubic Feet/Min.	Theoretical Meter Volume, (V _m) ft ³ , per point	Theoretical Meter Volume, (V _m) ft ³ , total	Stack Temp, °F	Meter Temp Inlet, °F	Meter Temp Outlet, °F	Pump Vacuum, "Hg	Probe Temp, °F	Filter Temp, °F	CPM Filter Temp, °F	Impinger Outlet Well Temp °F
1-1	2118	.015	.41	521.550	.122	.402	1.205		379	91	91	1	252	254	85	67
-1	2121	.015	.41	522.777	.122	.402	1.205	522.755	379	91	91	1	253	253	85	67
-2	2124	.015	.41	523.98	.122	.402	1.205	523.960	373	91	91	1	252	253	85	65
-2	2127	.015	.41	525.17	.122	.402	1.205	525.165	373	91	91	1	253	253	85	65
-3	2130	.015	.41	526.40	.122	.402	1.205	526.370	378	92	91	1	252	251	85	64
-3	2133	.015	.41	527.58	.122	.402	1.205	527.575	378	92	91	1	252	251	85	64
-4	2136	.015	.41	528.82	.122	.402	1.205	528.780	381	92	91	1	252	250	85	63
-4	2139	.015	.41	530.06	.122	.402	1.205	529.985	381	92	91	1	251	251	85	63
-5	2142	.010	.3	531.22	.100	.328	1.984	531.190	382	92	91	1	252	252	85	66
-5	2145	.010	.3	532.19	.100	.328	1.984	532.174	382	92	91	1	251	250	85	66
	2149			533.213				533.158								
2-1	2151	0.03	.82	533.213	.173	.568	1.704		381	92	91	3	251	250	84	61
-1	2154	0.03	.82	534.91	.173	.568	1.704	534.917	381	92	91	3	252	251	84	61
-2	2157	0.03	.82	536.64	.173	.568	1.704	536.621	378	93	91	3	253	254	82	60
-2	2200	0.03	.82	538.35	.173	.568	1.704	538.325	378	93	91	3	252	253	82	60
-3	2203	0.025	.68	540.04	.158	.518	1.555	540.029	383	93	91	3	253	250	81	60
-3	2206	0.025	.68	541.61	.158	.518	1.555	541.584	383	93	91	3	252	251	81	60
-4	2209	0.020	.55	543.14	.141	.464	1.391	543.139	376	93	91	2	251	250	81	62
-4	2212	0.020	.55	544.55	.141	.464	1.391	544.530	376	93	91	2	250	252	81	62
-5	2215	0.015	.41	545.94	.122	.402	1.205	545.921	381	93	90	1	252	250	81	64
-5	2218	0.015	.41	547.13	.122	.402	1.205	547.126	381	93	90	1	253	251	81	64
	2221			548.368				548.331								
3-1	2224	0.03	.83	548.368	.173	.573	1.719		374	92	90	3	251	251	82	64
-1	2227	0.03	.83	550.10	.173	.573	1.719	550.087	374	92	90	3	252	251	82	64
-2	2230	0.03	.83	551.81	.173	.573	1.719	551.806	376	92	90	3	251	250	79	59
-2	2233	0.03	.83	553.63	.173	.573	1.719	553.525	376	92	90	3	253	252	79	59
-3	2236	0.035	.97	555.26	.187	.619	1.857	555.244	379	93	90	4	252	250	78	57
-3	2239	0.035	.97	557.29	.187	.619	1.857	557.101	379	93	90	4	251	251	78	57

Isokinetic Sampling Field Data Sheet-M202

Project Number: M133003 Date: 7/23/13 Test Number: 3
 Client: UNIVERSITY OF IOWA Test Location: BOILER OUTLET DUCT Operator: DT Test Tech: AD
 Plant: HURST BOILER PLANT Test Method: 5 1202 Page Number: 2 of 2

Port-Point #.	Time	(ΔP)	Orifice Setting (ΔH)	Meter Volume (V _m) ft ³ , Actual	Square Root, ΔP	Meter Rate, Cubic Feet/Min.	Theoretical Meter Volume, (V _m) ft ³ , per point	Theoretical Meter Volume, (V _m) ft ³ , total	Stack Temp, °F	Meter Temp Inlet, °F	Meter Temp Outlet, °F	Pump Vacuum, "Hg	Probe Temp, °F	Filter Temp, °F	CPM Filter Temp, °F	Impinger Outlet Well Temp °F
3-4	2242	0.03	.83	559.00	.173	.573	1,719	558.958	374	93	90	4	254	251	77	56
-4	2245	0.03	.83	560.72	.173	.573	1,719	560.677	374	93	90	4	253	252	77	56
-5	2248	0.025	.76	562.43	.158	.523	1,570	562.396	372	93	90	3	252	251	77	57
-5	2251	0.025	.70	563.98	.158	.523	1,570	563.966	372	93	90	3	253	250	77	57
	2254			565.77				565.536								
4-1	2259	0.040	1.11	565.777	.200	.660	1,979		382	92	90	5	251	250	78	55
-1	2302	0.040	1.11	567.79	.200	.660	1,979	567.756	382	92	90	5	252	251	78	55
-2	2305	0.045	1.24	569.74	.212	.700	2,099	569.735	380	93	89	5	253	252	76	53
-2	2308	0.045	1.24	571.87	.212	.700	2,099	571.834	380	93	89	5	252	251	76	53
-3	2311	0.040	1.11	573.98	.200	.660	1,979	573.933	379	93	89	5	253	251	75	53
-3	2314	0.040	1.11	575.92	.200	.660	1,979	575.912	379	93	89	5	251	250	75	53
-4	2317	0.046	1.11	577.90	.200	.660	1,979	577.891	377	93	89	5	253	250	75	53
-4	2320	0.040	1.11	579.88	.200	.660	1,979	579.870	377	93	89	5	252	250	75	53
-5	2323	0.040	1.11	581.86	.200	.660	1,979	581.849	377	93	89	5	252	250	74	53
-5	2326	0.040	1.11	583.84	.200	.660	1,979	583.828	377	93	89	5	251	251	74	53
	2329			585.867				585.807								
5-1	2335	.02	.57	585.867	.141	.475	1,426		319	90	89	3	250	250	76	53
-1	2338	.02	.57	587.31	.141	.475	1,426	587.293	319	90	89	3	251	250	76	53
-2	2341	.02	.57	588.75	.141	.475	1,426	588.719	324	91	89	3	252	251	75	51
-2	2344	.02	.57	590.21	.141	.475	1,426	590.145	324	91	89	3	251	250	75	51
-3	2347	.02	.57	591.60	.141	.475	1,426	591.571	322	91	89	3	253	252	75	51
-3	2350	.02	.57	593.04	.141	.475	1,426	592.997	322	91	89	3	252	251	75	51
-4	2353	.025	.72	594.45	.158	.531	1,594	594.423	317	91	89	3	254	250	75	51
-4	2356	.025	.72	596.23	.158	.531	1,594	596.017	317	91	89	3	252	251	75	51
-5	2359	.02	.57	597.68	.141	.475	1,426	597.611	316	91	88	3	254	251	75	51
-5	0002	.02	.57	599.19	.141	.475	1,426	599.037	316	91	88	3	253	250	75	51
	0005			600.513				600.463								

Time:	Steam Flow:	Metering:	Collector:	Boehouse:	ID For:
9:15p.	10.5K	36%	8" W.C.	10.8/10.8" W.C.	77% 9:15p. start
9:30p.	11.8K.	38%	9"	11.0/11.3"	81% Run #3.
9:45p.	12K.	40%	11"	11.0/11.3"	87%
10:00p.	11.5K	35%	8"	11.0/11.3"	80%
10:15p.	12.2K.	41%	14"	11.0/11.3"	91%
10:30p.	10.9K.	39%	9"	11.2/11.3"	80%
10:45p.	11.9K.	40%	14"	11.2/11.3"	93%
11:00p.	11K.	38%	10"	11.3/11.3"	90%
11:15p.	10.7K.	36%	10"	11.3/11.3"	85%
11:30p.	12.2K.	39%	14"	11.2/11.3"	95%
11:45p.	11.3K.	35%	11"	11.2/11.3"	86%
12:00p.	10.6K.	29%	8"	11.3/11.3"	79%

← 12:05p.
Run #3

Time:	Steam Flow:	Metering:	Collector:	Booghouse:	ID Con:
6:30p.	12.5k.	3370	9" W.C.	11.2/11.3" W.C.	7970
6:45p.	11.8k.	3170	9"	11.1/11.1"	7970
7:00p.	11.6k.	3470	8"	11.1/11.2"	7970
7:15p.	11.6k.	3070	7"	10.4/10.4"	7470
7:30p.	11.3k.	3070	8"	10.8/10.8"	7170
7:45p.	11.1k.	3070	7"	10.4/10.5"	7470
8:00p.	11.7k.	3170	9"	11.2/11.3"	7970
8:15p.	10.5	3170	1.2"	11.3/11.3"	8070
8:30p.	11.1	3970	8"	11.1/11.0"	7870
8:45p.	11.9	3070	1.0"	11.2/11.3"	8470

7:54
Run #2 done

TIME	STEAM FLOW	METERING BIN	COLLECTOR AP	BAKHOUSE AP	IAS FAN VFD
4:00 P	10.7K	33%	1.0" W.C.	11.2/11.3" W.C.	83%
4:15 P	13.0K	31%	1.0" W.C.	11.3/11.3" W.C.	83%
4:30 P	13.4K	33%	1.0" W.C.	11.3/11.3" W.C.	89%
4:45 P	9.4K	18%	1.4" W.C.	7.8/7.9" W.C.	62%
5:00 P	10.5K	23%	1.6"	8.9/8.9"	68%
5:15 P	11.3 K	25.9%	1.7"	10.1/10.1"	73.2%
5:30 P	11.9 K	30.2%	1.8"	10.6/10.6"	75.3%
5:45 P	12.3 K	30.4%	1.9"	11.2/11.2"	78.2%
6:00 P	11.8 K	29.4%	1.8"	10.8/10.8"	75.4%
6:15 P	11.5 K	28%	1.7"	10.3/10.3"	74%

→ 5:02 P.
Run #2 starte

TIME	START/STOP FLOW	METERING IS IN	COLLECTOR AP	BAGHOUSE AP	ID FAN VFD
1:30 P	11.4 K	33%	0.8" WC	10.6/10.6" WC	76%
1:45 P	11.9 K	33%	1" WC	11.2/11.3" WC	81%
2:00 P	12.1 K	33%	1" WC	11.2/11.3" WC	80%
2:15 P	11.6 K	30%	0.9" WC	11.2/11.1" WC	77%
2:30 P	12.8 K	35%	1.1" WC	11.2/11.3" WC	84%
2:45 P	12.1 K	32%	1.0" WC	11.2/11.3" WC	80%
3:00 P	13.0 K	34%	1.1" WC	11.3/11.3" WC	84%
3:15 P	12.7 K	32%	1.0" WC	11.2/11.3" WC	84%
3:30 P	12.5 K	31%	0.9" WC	11.2/11.3" WC	81%
3:45 P	10.7 K	30%	1.0" WC	11.2/11.3" WC	81%

Run #1
START @
12:05 P
7-23-2013

~~Run #1~~
~~START @~~

TIME	SEAFM FWD	METERING BIN	COUZZOR AP	BAGHOUSE AP	FD FAN VFD
11:00 A	11.0K	33.4%	0.9"WC	11.2/11.3"WC	83%
11:15 A	11.4K	35.0%	0.9"WC	11.2/11.3"WC	84%
11:30 A	10.6K	30.3%	0.8"WC	11.3/11.3"WC	79%
11:45 A	12.0K	35.4%	1.4"WC	11.2/11.3"WC	92%
12:00 P	10.9K	28.3%	0.8"WC	11.2/11.3"WC	78%
12:15 P	10.5K	27.0%	0.8"WC	9.8/9.8"WC	72%
12:30 P	10.5K	27%	0.7"WC	9.6/9.7"WC	71%
12:45 P	10.4K	27%	0.6"WC	9.1/9.2"WC	70%
1:00 P	12.6K	38%	1.1"WC	11.2/11.3"WC	83%
1:15 P	11.2K	29%	0.8"WC	10.6/10.5"WC	76%

ATTACHMENT 7

Observer: <u>Scott Postma</u>	Testing Firm: <u>METCO, Inc. MUSTARD PLANT</u>
Company: <u>GREEN GAYDALE</u>	Team Leader: <u>Mr. Johnson ROBERTSON</u>
Location: <u>Coffeyville, KS - Corralville IA</u>	Phone Number: <u>(802) 252-4500 (630) 841-5205</u>
Source: <u>Boiler MACT test Unit 3</u>	

R1:1205

EPA new METHODS 7E and 6C CHECKLIST

(Instrumental Analyzer Procedure Only)

Protocol Gases used (Section 1.3, M7E)?	<u>Yes</u> / No
Free NH ₄ reacts w/ SO ₂ to form particulate sulfite, is the interfering, free NH ₄ , in the source gas _____?	<u>Yes</u> / No
Are the Sampling system components glass , <u>Teflon</u> , or stainless steel (Section 6.1, M7E) _____?	<u>Yes</u> / No
Sampling rate maintained above 10 % of the flow at which the system response time was measured _____?	<u>Yes</u> / No
Sampling components above the moisture dew point temperature _____?	<u>Yes</u> / No
Sampling probe made of glass and/or stainless steel (Section 6.2, M7E) _____?	<u>Yes</u> / No
Sampling probe of sufficient length to get to all points, one, three, twelve? <u>4.5', 3.5' dia</u> _____?	<u>Yes</u> / No
Is particulate filter in the stack filter <u>probe sintered</u> _____?	<u>Yes</u> / No
Out-of-Stack filter used _____?	Yes / No
Sampling line made of <u>Teflon</u> or other material _____?	<u>Yes</u> / No
Sampling line to pump and analyzer conditioned to avoid absorbing gas or otherwise altering sample _____?	Yes / No
Sampling pump of sufficient power to pull a critical vacuum and minimize the response time <u>52 mins</u> _____?	<u>Yes</u> / No
Sampling pump made of non-reactive material _____?	<u>Yes</u> / No
Does manifold allow for introducing calibration gas directly to the analyzer _____?	<u>Yes</u> / No
Does the manifold allow for introducing calibration gas to the valve following the probe, flooding the probe? _____?	Yes / No
<u>Dry-basis</u> or wet-basis? <u>GAS CONDITIONER</u>	
For Dry-basis , Is temperature sufficiently high to avoid condensation before conditioning system? (6.2.4, 7E) <u>250</u> _____?	Yes / No
Conditioning components in-line to remove moisture for dry systems: _____?	<u>Yes</u> / No
Did the Dry-basis measurements have a condenser, <u>dryer</u> , or other: _____?	<u>Yes</u> / No
Did the Dry-basis measurements using a heated sampling line, probe: <u>Yes</u> _____?	<u>Yes</u> / No
Conditioning components in-line to heat and/or dilute the sample to avoid condensation for wet systems? _____?	Yes / No
For Wet-basis , Is temperature sufficiently high to avoid condensation to analyzer _____?	Yes / No
Did the Wet-basis measurements have heated sampling line and transport equipment _____?	Yes / No
What is the Dilution Ratio of Wet-basis system: <u>No Dilution</u> _____?	Yes / No
Is the sampling pump made of non-reactive material (6.2.5, 7E)? : _____?	<u>Yes</u> / No
Is the sampling pump able to pull a sufficient amount to minimize sample time (< _____ minutes) _____?	Yes / No
Is the sampling pump made of non-reactive material: _____?	Yes / No
Did they demonstrate that the system, including the sampling pump, is leak free _____?	<u>Yes</u> / No
What is the vacuum of the eductor (ejector) pump to pull the critical orifice vacuum (<u>20</u> > 15" Hg)? _____?	Yes / No
(See Section 6.2.6 and 6.2.7 for additional requirements)	Yes / No
Is the SO₂ analyzer type a non-dispersive infrared, chemiluminescence, or ultraviolet?(6.2.8.1, 13, 7E) <u>NO SO₂</u> _____?	Yes / No
Is the NO_x analyzer type a chemiluminescence : _____?	<u>Yes</u> / No
Does the NO _x instrument use a NO₂ to NO converter upstream of the analyzer : <u>Stainless steel</u> _____?	<u>Yes</u> / No
Other instrument and setup: _____?	Yes / No
Analyzer Calibration Error (ACE) , before the 1 st run and after any failed bias test? (Section 13.1, 8.2.3, 7E) <u>0 mtd high</u> _____?	<u>Yes</u> / No

Did they do a 3-pt ACE for Non-Dilution systems, _____ ? or, <u>Yes</u> / No																						
3-pt System Calibration Error (SCE) for Dilution systems <u>N/A</u> ?	Yes / No																					
-For dilution, the difference between cal gas and analyzer when introduced to probe and all conditioning system components (calibration mode) within 2% <u>N/A</u> or ≤ 0.5 ppmv ?	Yes / No																					
Were the 3-points equal to low (0-20) , mid (40-60) , high (= to cal span) _____ ?	Yes / No																					
ACE = $((C \text{ direct measured} - C \text{ gas}) / (C \text{al Span})) \times 100$																						
System Bias (SB) (2-point test, Sections 13.2, 8.2.5 and 8.5, 7E) <u>45.54 span</u>	<u>Yes</u> / No																					
Did the 2-pt SB or the SCE for all runs within $\pm 5\%$? SB= _____, Run #s <u>All</u> ?	Yes / No																					
Or within ≤ 0.5 ppmv, _____ ?																						
SB = $((C \text{ measured} - C \text{ direct}) / *C \text{al Span}) \times 100$																						
Drift (13.3, 7E)	Yes / No																					
Is the Drift for Low level and High level $\leq 3.0\%$ (or ≤ 0.5 ppmv) _____ ?																						
Drift = Absolute value (post-run SB - Pre-run SB)																						
SO2 allowable Calibration Gases (7.1, 6C)	Yes / No																					
SO2 in N2 ? (or in air) ? SO2 and CO2 in N2 ? SO2 and O2 in N2 ?	Yes / No																					
SO2 & CO2 & O2 in N2 ? CO2 & NOx in N2 ? CO2 & SO2 & NOx in N2 ?	Yes / No																					
Other? Other? Other?																						
Protocol Calibration Gases used (7.1, 7E) <u>Procedure G1</u> ?	Yes / No																					
Document Provided <u>✓</u> Expiration Date(s) _____ ?	Yes / No																					
If a low Conc. Analyzer used, do they have a Manufacturer's Stability Test (MST) (6.2.8.2, 7E) _____ ?	Yes / No																					
Were the gases in the following ranges: Low (0-20) Concentration <u>CO2 Cal Gas / N2</u> ?	<u>Yes</u> / No																					
Mid (40-60) <u>18.48</u> Concentration <u>ex 1/3/16</u> ?	<u>Yes</u> / No																					
High (= 20 to 100% of measurements cal span) <u>45.54</u> Concentration <u>ex Nov 14/15</u> ?																						
SO2 and NOx Interference Check (IC) (13.4, 8.2.7, 7E)	Yes / No																					
Was IC sum (all gases) $< 2.50\%$ span ≤ 0.5 ppm span 5-10ppm or 0.2 ppm < 5 ppm _____ ?																						
Were the following gases introduced separately or in a mixture in the IC (Table 7E-3) _____ ?	<u>Yes</u> / No																					
Was test conducted both with and without NOx (NO2 and NO, if RM at > 20 ppm NOx, IC at 80-100) _____ ?																						
(If instrument to measure at < 20 ppm, select NOx calibration gas near stack) <u>@ office</u>																						
<table border="1"> <thead> <tr> <th>Potential interferent</th> <th>Hot wet</th> <th>Dried</th> </tr> </thead> <tbody> <tr> <td>CO2</td> <td>5 and 15 %</td> <td>5 and 15%</td> </tr> <tr> <td>H2O</td> <td>25 %</td> <td>1 %</td> </tr> <tr> <td>N2O, NH3, HCl</td> <td>10</td> <td>10</td> </tr> <tr> <td>NO, NO2</td> <td>15 ppmv</td> <td>15 ppmv</td> </tr> <tr> <td>SO2</td> <td>20</td> <td>20</td> </tr> <tr> <td>CO, CH4, H2</td> <td>50</td> <td>50</td> </tr> </tbody> </table>	Potential interferent	Hot wet	Dried	CO2	5 and 15 %	5 and 15%	H2O	25 %	1 %	N2O, NH3, HCl	10	10	NO, NO2	15 ppmv	15 ppmv	SO2	20	20	CO, CH4, H2	50	50	
Potential interferent	Hot wet	Dried																				
CO2	5 and 15 %	5 and 15%																				
H2O	25 %	1 %																				
N2O, NH3, HCl	10	10																				
NO, NO2	15 ppmv	15 ppmv																				
SO2	20	20																				
CO, CH4, H2	50	50																				
NOTE: The IC only needs on one instrument prior to initial use in the field and valid for the life of the instrument																						
NOTE: Method 6C uses an unmodified Method 6 trains and the above procedures substituting SO2 for NOx																						
Dilution type SO2 instruments must use Section 16, 6C procedures, page 263.																						
NO2 to NO Conversion Efficiency Test (NOxCET) (13.5, 7E)	Yes / No																					
Is the NO2 to NO (CET) greater than or equal to 90% <u>Do it later</u> ?	Yes / No																					
The NO2 gas is required to be within 40 - 60 ppmv , was it (7.1.4, 7E) <u>1/2 high gas 1/2 zero into tank</u> ?	Yes / No																					
Alternative converter efficiency test, NO gas is required (16.2, 7E) _____ ?	Yes / No																					
Were the NOxCET gases Protocol gases _____ ?																						
NOxCET = $(C \text{ direct} / C \text{al gas value}) \times 100$ <u>2%</u>																						
Alternative Dynamic Spiking (13.6, 7E)	Yes / No																					
Were the pre and post (ADS) spikes within 100 $\pm 10\%$ or ≤ 0.20 ppm _____ ?	<u>Yes</u> / No																					
Was the Effluent Correction calculation used _____ ?																						
C bias adjusted = $(C - C \text{ ave. low level bias } i \text{ and } f) \times ((C \text{ upscale cal gas}) / (C \text{ ave. upscale} - C \text{ ave. low}))$																						

Was a Dual Range Analyzer used? (6.2.8.1, 7E)	?	Yes / No
What were the ranges	N/A	Yes / No
Were both ranges QA passed with IC, ACE, SB, and Drift ? If not, which one failed	N/A	Yes / No
Sample Collection, Preservation, Storage, and Transport (8.1, 6C --> 8.1, 7E)		
Deviations from the method identified	to be done 7/24 20pts	Yes / No
Prior Stratification test conducted	? Pollutant sampled	Yes / No
Current Stratification test conducted	? Pollutant sampled	Yes / No
12 test points sampled	? or 3-pts sampled at 16.7, 50.0, 83.3 %	Yes / No
Did they sample each point for at least 2 X system response time	Yes ? Sys. Resp. time 2 min	Yes / No
Is the difference at each point less than 5% or +/- 0.5 ppm,		Yes / No
If so, then single point sampling at closest point is acceptable		Yes / No
If not, then were they less than 10.0% or +/- 1.0 ppm,		Yes / No
If so, then 3-pt sampling is allowable at 16.7, 50.0, and 83.3%		Yes / No
If not then 12-pt sampling is required		Yes / No
If stack minimally strat. (5-10%) & greater than 7.8 feet, then 3-pt if sampling at highest averaged pt		Yes / No
Initial Measurement System Performance Tests (8.2, 7E)		
Calibration Gas Verification (8.2.1) Manufacturers gas document available, complete, and current		Yes / No
Measurement System Preparation (8.2.2) Did they assemble, prep, precondition, adjust the sample rate and the dilution ratio		Yes / No
	Sampling rate = Dilution ratio =	Yes / No
Calibration Error Test (8.2.3) 3-pt pre run ACE performed, or post failed run ACE		Yes / No
Were ACE results recorded and appropriately responded to (see ACE test above)		Yes / No
Was the 3-pt ACE and SCE done at 3 concentration points		Yes / No
Was NOxCET conducted before the field use	? Factory adjustment is acceptable	Yes / No
Initial System Bias and System Calibration Error Checks, (8.2.5)		Yes / No
Which gas best emulates the stack concentration and is used as the upscale gas	High	Yes / No
Upscale SB gas introduced at probe	No ? 95% response time (RT) recorded final value	Yes / No
Low level or zero gas introduced and 95% response time (RT) and concentration recorded		Yes / No
Was the longer of the two times the time recorded		Yes / No
From this data, is the RT and bias calculated 7E-2 (or system bias for dilution 7E-3)		Yes / No
Is SCE <= 2.0 %	✓ ? Is SB <= 5 %	✓ ? Is Drift <= 3 %
Dilution systems can use the 3-pt in place of the 2-pt if injected at the probe		Yes / No
Dilution type Special Considerations (8.3, 7E)		
(1) Is critical orifice and dilution ratio (DR) selected so that the dew point is below line conditions		Yes / No
(2) Did they use a high quality, accurate probe controller to maintain the dilution ratio		Yes / No
(3) Molecular weight differences between cal and stack gas must be addressed since errors introduced in the DR and measurement bias		Yes / No
Sample Collection (8.4, 7E)		
Was the probe purged for 2XRT, traversing, maintaining sampling rate and DR		Yes / No
Was at least one valid point per minute recorded with a minimum point sampling time of 2XRT at the first point, for a minimum, with longer periods helping with temporal variation but subsequent points not required to be at 2XRT		Yes / No
Single or multi-hole probe	? Sampling rate maintained +/- 10 %	Yes / No
Post-Run System Bias Check and Drift Assessment (8.5, 7E)		
Did they run, and pass, a 2-pt SCE check, no adjustments, after each run		Yes / No
If failed, did they diagnosis and fix the problem, pass a 3-pt & 2-pt SB		Yes / No
Did they pass drift		Yes / No
NOTE: gases can be injected in any order		
Quality Control (9.0, 7E)		
Did they meet the mandatory requirements of The SUMMARY TABLE OF QA/QC, page 296		Yes / No

Did they meet the Suggested requirements of The SUMMARY TABLE OF QA/QC, page 296 _____?	Yes / No
Comments: _____?	
<u>Calibration and Standardization</u> (10.0, 7E)	
Did they do the 3-pt CE (8.2.3) and 8.2.5 as required and as indicated above _____?	Yes / No
Did they do the SB and SCE checks (8.5) as indicated above _____?	Yes / No
<u>Analytical Procedures</u> (8.0, 7E)	
Did they follow section 8.0 above _____?	Yes / No
<u>Calculations and Data Analysis</u> (12.0, 7E)	
Will they, did they perform the Section 12 calculations _____?	Yes / No
<u>Dynamic Spiking Procedures</u> (16.1, 7E)	
Did they following and produce the traceability protocol _____?	Yes / No
Was the spike done before and after _____? Did the concentration bracket _____?	Yes / No

Observer: <u>Scott Postma</u>	Testing Firm: _____
Company: _____	Team Leader: _____
Location: _____	Phone Number: _____
Source: <u>RTO</u>	

METHOD 25A OBSERVATION CHECKLIST

(Refer to the Instrumental Methods Datasheet)

<p>Run Number: <u>1</u> Analyzer ID: <u>VIG 20/2 with 2 channels and VIG</u></p> <p>Analyzer Make: <u>GC with FID analyzer</u></p> <p>Analyzer Manufacturer: <u>VIG/JUM/Teledyne</u></p> <p>Analyzer Model: <u>Model</u></p> <p>Test Location: _____</p> <p>Test Date: _____</p> <p>(Calibration)</p> <p>Calibration gas: _____ (CH4/C3H8/other)</p> <p>Protocol #1 calibration gas? _____ Yes / No</p> <p>Protocol documents available? _____ Yes / No</p> <p>Documents current? _____ Yes / No</p> <p>G1 certified? _____ Yes / No</p> <p>Expiration date? _____</p> <p>NOTES: <u>Ranges used:</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>LOW RANGE (span = 100 ppm)</p> <p>Low range 25 to 35 % of span? <u>Yes/no</u>, conc.= _____</p> <p>Mid range 45 to 55 % of span? <u>Yes/no</u>, conc.= _____</p> <p>High range 80 to 90 % of span? <u>Yes/no</u>, conc.= _____</p> <p>MID RANGE (span = 500 ppm)</p> <p>Low range 25 to 35 % of span? <u>Yes/no</u>, conc.= _____</p> <p>Mid range 45 to 55 % of span? <u>Yes/no</u>, conc.= _____</p> <p>High range 80 to 90 % of span? <u>Yes/no</u>, conc.= _____</p> <p>HIGH RANGE (span = 10,000 ppm)</p> <p>Low range 25 to 35 % of span? <u>Yes/no</u>, conc.= _____</p> <p>Mid range 45 to 55 % of span? <u>Yes/no</u>, conc.= _____</p> <p>High range 80 to 90 % of span? <u>Yes/no</u>, conc.= _____</p> <p>Gas stream alkanes, alkenes, alkynes? _____ YES/No</p> <p>Any other gases expected in stream? _____ YES/No</p> <p>Specific Gases: <u>Amines, oxygenates</u></p> <p>Were Response Factors used in the calculations to proportion to a VOC mass? <u>Yes</u> YES/No</p> <p>Moisture can diminish the response of FIDs.</p> <p>Is moisture less than 10% in the stream? <u>1.4%</u> Yes/No</p> <p>Type of bag: <u>tedlar / mylar / other</u> (specify)</p> <p>Was the bag leak checked before use? _____ Yes / No</p> <p>Was the sample line purged with effluent? _____ Yes / No</p> <p>Is the bag shielded from UV light? _____ Yes / No</p>	<p>Run Number: <u>2</u> Analyzer ID: <u>VIG 20/2 with 2 channels and VIG</u></p> <p>Analyzer Make: <u>GC analyzer with FID</u></p> <p>Analyzer Manufacturer: <u>VIG/JUM/Teledyne</u></p> <p>Analyzer Model: <u>Model</u></p> <p>Test Location: _____</p> <p>Test Date: _____</p> <p>(Calibration)</p> <p>Calibration gas: _____ (CH4/C3H8/other)</p> <p>Protocol #1 calibration gas? _____ Yes / No</p> <p>Protocol documents available? _____ Yes / No</p> <p>Documents current? _____ Yes / No</p> <p>G1 certified? _____ Yes / No</p> <p>Expiration date? _____</p> <p>NOTES: <u>Ranges used:</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>LOW RANGE (span = 100 ppm)</p> <p>Low range 25 to 35 % of span? <u>Yes/no</u>, conc.= _____</p> <p>Mid range 45 to 55 % of span? <u>Yes/no</u>, conc.= _____</p> <p>High range 80 to 90 % of span? <u>Yes/no</u>, conc.= _____</p> <p>MID RANGE (span = 500 ppm)</p> <p>Low range 25 to 35 % of span? <u>Yes/no</u>, conc.= _____</p> <p>Mid range 45 to 55 % of span? <u>Yes/no</u>, conc.= _____</p> <p>High range 80 to 90 % of span? <u>Yes/no</u>, conc.= _____</p> <p>HIGH RANGE (span = 10,000 ppm)</p> <p>Low range 25 to 35 % of span? <u>Yes/no</u>, conc.= _____</p> <p>Mid range 45 to 55 % of span? <u>Yes/no</u>, conc.= _____</p> <p>High range 80 to 90 % of span? <u>Yes/no</u>, conc.= _____</p> <p>Gas stream alkanes, alkenes, alkynes? _____ YES/No</p> <p>Any other gases expected in stream? _____ YES/No</p> <p>Specific Gases: <u>Amines, oxygenates</u></p> <p>Were Response Factors used in the calculations to proportion to a VOC mass? <u>Yes</u> YES/No</p> <p>Moisture can diminish the response of FIDs.</p> <p>Is moisture less than 10% in the stream? <u>1.2%</u> Yes/No</p> <p>Type of bag: <u>tedlar / mylar / other</u> (specify)</p> <p>Was the bag leak checked before use? _____ Yes / No</p> <p>Was the sample line purged with effluent? _____ Yes / No</p> <p>Is the bag shielded from UV light? _____ Yes / No</p>
---	---

Are the target VOCs non-polar? Yes / No Will a recovery study be conducted per §7.6.2 Yes / No <u>Recovery study not required for this test.</u> Is the Span 1.5-2.5 times the conc./permit limit? Yes / No <u>Correlation of span to 1.5 to 2.5 times the emission standard not necessary for a destruction and removal efficiency (DRE) test.</u> (M25A Quality Assurance) Calibration Error, for each gas, less than (<) $\pm 5\%$ of calibration Gas Value? Yes/No Zero Drift less than (<) $\pm 3\%$ of the span value? Yes/No Calibration Drift less than (<) $\pm 3\%$ of the span value? Yes/No Is the average Response Time <2 minutes? Yes/No Was the measured gas concentration adjusted for the drift as method 6C? Yes/No (Other) Is the entire sampling system properly heated? Yes/No Is the entire sampling system insulated? Yes/No Is the sample line temperature being recorded? Yes/No Is an appropriate gas being used for bias checks? Yes/No Is the testing in accordance with the protocol? Yes/No Were all conditions in protocol met? Yes/No	Are the target VOCs non-polar? Yes / No Will a recovery study be conducted per §7.6.2 Yes / No <u>Recovery study not required for this test.</u> Is the Span 1.5-2.5 times the conc./permit limit? Yes / No <u>Correlation of span to 1.5 to 2.5 times the emission standard not necessary for a destruction and removal efficiency (DRE) test.</u> (M25A Quality Assurance) Calibration Error, for each gas, less than (<) $\pm 5\%$ of calibration Gas Value? Yes/No Zero Drift less than (<) $\pm 3\%$ of the span value? Yes/No Calibration Drift less than (<) $\pm 3\%$ of the span value? Yes/No Is the average Response Time <2 minutes? Yes/No Was the measured gas concentration adjusted for the drift as method 6C? Yes/No (Other) Is the entire sampling system properly heated? Yes/No Is the entire sampling system insulated? Yes/No Is the sample line temperature being recorded? Yes/No Is an appropriate gas being used for bias checks? Yes/No Is the testing in accordance with the protocol? Yes/No Were all conditions in protocol met? Yes/No
--	--

If you answered "NO" to any question, there may be a problem with the testing that could invalidate the test run!

Comments: _____

- m26 no sodium hydroxide
 - not checking temp every 5 min on 26 as required >120°C
 R1: 1205-1435
 R2: 1530-

ATTACHMENT 8

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
CONFIDENTIALITY NOTICE

Facility Name <u>UNIVERSITY OF IOWA OAKDALE CAMPUS</u>	
Facility Address <u>2320 CROSSPARK ROAD CORNVILLE IA 52241</u>	
Inspector (print) <u>Scott Postme</u>	
U.S. EPA, Region VII, 901 N. 5th St., Kansas City, KS 66101	Date <u>3/26/13</u>

The United States Environmental Protection Agency (EPA) is obligated, under the Freedom of Information Act, to release information collected during inspections to persons who submit requests for that information. The Freedom of Information Act does, however, have provisions that allow EPA to withhold certain confidential business information from public disclosure. To claim protection for information gathered during this inspection you must request that the information be held CONFIDENTIAL and substantiate your claim in writing by demonstrating that the information meets the requirements in 40 CFR 2, Subpart B. The following criteria in Subpart B must be met:

1. Your company has taken measures to protect the confidentiality of the information, and it intends to continue to take such measures.
2. No statute specifically requires disclosure of the information.
3. Disclosure of the information would cause substantial harm to your company's competitive position.

Information that you claim confidential will be held as such pending a determination of applicability by EPA.

I have received this Notice and <u>DO NOT</u> want to make a claim of confidentiality at this time.	
Facility Representative Provided Notice (print) <u>STEVE KOTTENBERG</u>	Signature/Date <u>Steve KOTTENBERG 3/26/13</u>

I have received this Notice and <u>DO</u> want to make a claim of confidentiality.	
Facility Representative Provided Notice (print)	Signature/Date

Information for which confidential treatment is requested:

NONE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
CONFIDENTIALITY NOTICE

Facility Name OAKDALE CAMPUS, UNIVERSITY OF IOWA	
Facility Address OFFICE. 207 W. BURLINGTON, IOWA CITY, IOWA 52242	
Inspector (print) Scott Postma	
U.S. EPA, Region VII, 901 N. 5th St., Kansas City, KS 66101	Date 7/23/13

The United States Environmental Protection Agency (EPA) is obligated, under the Freedom of Information Act, to release information collected during inspections to persons who submit requests for that information. The Freedom of Information Act does, however, have provisions that allow EPA to withhold certain confidential business information from public disclosure. To claim protection for information gathered during this inspection you must request that the information be held CONFIDENTIAL and substantiate your claim in writing by demonstrating that the information meets the requirements in 40 CFR 2, Subpart B. The following criteria in Subpart B must be met:

1. Your company has taken measures to protect the confidentiality of the information, and it intends to continue to take such measures.
2. No statute specifically requires disclosure of the information.
3. Disclosure of the information would cause substantial harm to your company's competitive position.

Information that you claim confidential will be held as such pending a determination of applicability by EPA.

I have received this Notice and <u>DO NOT</u> want to make a claim of confidentiality at this time.	
Facility Representative Provided Notice (print) Mark Maxwell	Signature/Date Mark Maxwell / 07-24-13

I have received this Notice and <u>DO</u> want to make a claim of confidentiality.	
Facility Representative Provided Notice (print)	Signature/Date

Information for which confidential treatment is requested:

None

ATTACHMENT 9

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RECEIPT FOR DOCUMENTS AND SAMPLES

Facility Name UNIVERSITY OF IOWA, OAKDALE CAMPUS
Facility Address 2320 CROSSPARK ROAD, CORNELVILLE IA 52241

Documents Collected? YES___ (list below) NO ✓

Samples Collected? YES___ (list below) NO ✓ Split Samples: YES___ NO___

Documents/Samples were: 1)Received no charge___ 2)Borrowed___ 3)Purchased___

Amount Paid: \$___ Method: Cash___ Voucher___ To Be Billed___

The documents and samples described below were collected in connection with the administration and enforcement of the applicable statute under which the information is obtained.

Receipt for the document(s) and/or sample(s) described below is hereby acknowledged:

None

Facility Representative (print) STEVE KOTTENSTEIN	Signature/Date <i>Steve KOTTENSTEIN</i> 3/26/13
Inspector (print) COFF POSTMA	Signature/Date <i>COFF POSTMA</i> 3/26/13
U.S. EPA, Region VII, 901 N. 5th Street, Kansas City, KS 66101	

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RECEIPT FOR DOCUMENTS AND SAMPLES

Facility Name	UNIVERSITY OF IOWA, OAKDALE CAMPUS
Facility Address	MAIN OFFICE FOR ENVIRON/RAND 207 W BURLINGTON, IOWA CITY IOWA 52242

Documents Collected? YES ☒ (list below) NO ☐

Samples Collected? YES ☐ (list below) NO ☒ Split Samples: YES ☐ NO ☐

Documents/Samples were: 1) Received no charge ☐ 2) Borrowed ☐ 3) Purchased ☐

Amount Paid: \$ Method: Cash ☐ Voucher ☐ To Be Billed ☐

The documents and samples described below were collected in connection with the administration and enforcement of the applicable statute under which the information is obtained.

Receipt for the document(s) and/or sample(s) described below is hereby acknowledged:

① RAW DATA
② OPERATING DATA

Facility Representative (print)	Signature/Date
Mark Maxwell	Mark Maxwell/07-23-13
Inspector (print)	Signature/Date
SCOTT Postma	7/23/13
U.S. EPA, Region VII, 901 N. 5th Street, Kansas City, KS 66101	

DOCUMENT CONTROL CHECK SHEET

Media

Air	RCRA	Water	Other
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Activity Number IA-

Facility ID Number IA-2090004

Facility Name and Address University of Iowa
OKDALE CAMPUS

The following documents pertaining to this activity are contained in the package:

<u>Document</u>		<u>Yes</u>	<u>No</u>	<u>NA</u>
Final Report with attachments	_____ Pages	()	()	()
Field sheets	<u>3</u> Pages	(<input checked="" type="checkbox"/>)	()	()
Chain of Custody	_____ Pages	()	()	()
Field notes	_____ Pages	()	()	()
Analytical data sheets	_____ Pages	()	()	()
Photographic negatives (if applicable)	_____ Pages	()	()	()
Photographs (not included in this report)	_____ Pages	()	()	()
Pre-inspection documents	_____ Pages	(<input checked="" type="checkbox"/>)	()	()
Other documents (list below)				
<u>Note</u>	<u>3</u> Pages			
_____	_____ Pages			
_____	_____ Pages			
_____	_____ Pages			

(Note: If additional space is needed to list specific documents, utilize reverse side)

CERTIFICATION

I, the undersigned, certify that all of the documents pertaining to this activity that were in my possession have been listed above and were included in this package at the time this statement was signed.

Activity Leader's Signature and Date

Particulate, SO₂, HCl, & NO_x Advanced Control in One System

Advanced, low-density ceramic filter systems are now capable of removing particulate matter (PM), NO_x, SO₂, HCl, dioxins, and even mercury in a single system. Particulate matter is removed to ultralow levels (<2 mg/Nm³, 0.001 grains/dscf), while other pollutants can be removed at percentages greater than 90 percent. The Tri-Mer UltraCat Catalyst filter system is a cost-effective solution to many difficult pollution control issues.

Ceramic filters
Ceramic filters, often called candles because of their solid tube shape, have been used in pollution control for decades.

The original high-density candle filters were manufactured from refractory grains such as alumina or silicon carbide and pressed into the basic candle shape—a tube with a closed, rounded bottom and a flange at the top. The newer, low-density filters start as a slurry of refractory flours and are vacuum formed into shape. The contrast between types of ceramic filter elements is shown in Table 1.

Table 1

Contrast between types of ceramic filter elements			
Characteristics of high- and low-density ceramic-filter elements			
Structure	High density	Low density	
Density	Granular	Fibrous	
Filter drag	High	Low	
Porosity, % (inverse of resistance to flow)	0.3 - 0.4	2.8 - 0.9	
Tensile strength	High	Low	
Fracture mechanism	Brittle	Ductile	
Thermal shock resistance	Low	High	
Cost	High	Low	

There are hundreds of applications of these types of filters in Europe, Japan, and Australia. The filter elements are made in various lengths, but it is the latest generation of 3-meter (10-ft) long filters, on the market since 1997, that make industrial applications practical. The filters are placed in a housing module similar to a baghouse (see Figure 1).



For more information, contact Kevin Moss, Tri-Mer Business Development Director, Advanced Technologies. Direct line: (801) 294-5422, or kevin.moss@tri-mer.com

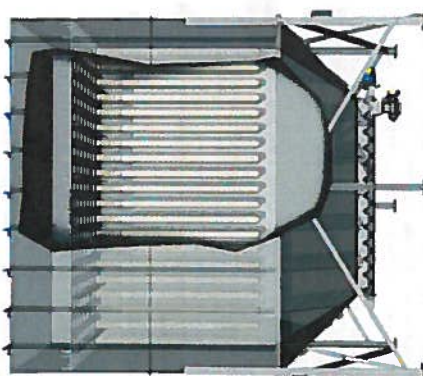


Figure 1 Many filters placed in a single module. Multiple modules are operated in parallel to handle large volumetric flow rates. (Multiple modules shown in Figure 8)

These lightweight ceramic filters solve many of the problems associated with "candle filters." While effective, the latter were brittle and prone to cracking and breakage from thermal shock and vibration. As shown in Figure 2, the filters maintain a very high, open area for low resistance to airflow, minimizing pressure drop and the number of elements required for a given flow rate. This high, open area also makes elements easy to clean using the standard reverse pulse-jet techniques associated with fabric filter baghouses (see Table 2).

Operating characteristics
Ceramic filters must operate above the condensation temperature of the pollutants, or the particulate will not release from the filter surface unless the temperature is raised and the material volatilizes, thus cleaning the filter. Table 3 shows typical operating temperatures for the ceramic filters. The filters are chemically inert and highly corrosion resistant, as would be expected from ceramic materials. Filters are manufactured in two varieties: standard Ultra temp filters and UltraCat catalyst filters.



Figure 2 Micrograph of filter elements composition

Table 2

Characteristics of low-density fibrous ceramic filter elements	
Form	Manufacture
Composition	Refractory fibers plus organic and inorganic binding agents
Porosity	About 80 - 90%
Density	About 0.3 - 0.4 g/cc
Support	Self-supporting from integral flange
Geometry	Outer diameter up to 150mm (6 in.) Length up to 3m (10 ft.)

The catalyst filter is identical to the standard filter, except that it has nanobots of SCR catalyst embedded in the filter walls for NO_x removal and dioxin destruction.

Particulate control

The typical level of PM at the outlet of the ceramic filters is less than 0.001 grains/dscf (2.0 mg/Nm³). This is true even with very heavy inlet loadings of several thousand milligrams per cubic meter. PM is captured on the face of the filter and does not penetrate deeply into the filter body, thus allowing for regenerative and complete cleaning. This is an engineered feature of the filter surface. The filter does not blind, and only over five to ten years does the pressure drop very gradually increase to the point that filters should be changed. Pressure drop for the new clean filter is approximately 6 inches w.g. Pressure drop can be lowered by adding more filter elements or footprint, and capital cost can be reduced by decreasing the filter count at the expense of fan horsepower.

The filter construction also means that standard reverse pulse jet methods, which send a pulse of compressed air down the center of the tube, can thoroughly clean the accumulated PM from the outer surface of the tube. Filters are cleaned on-line, with no need to isolate each housing module.

Typical filter life is 5 to 10 years. The filters are effective across the range of particle sizes, but are most often used when there is a large fraction of PM_{2.5} and submicron particulate and/or at high temperatures (see Table 4).

Table 3

Typical operating temperatures for the ceramic filters	
Filter name	Temperature range of operations
UltraTemp Standard	300°F to 1650°F
UltraTemp Standard	300°F to 1200°F
UltraCat Catalyst	350°F to 700°F
UltraCat Catalyst	350°F to 700°F

SO₂ and acid gas control
Both standard UltraTemp and catalyst UltraCat filter systems feature an option for dry injection of calcium or sodium-based sorbents.

Figure 3 Standard filter system for control of particulate, SO₂, HCl, and other gases



Injected in the duct, upstream of the filter modules, the additional sorbent particulate is easily captured along with its pollutant gas. The sorbent must be milled to small particle size to maximize surface area for maximum reactivity. The reaction occurs within the duct prior to the filter and at the filter cake that builds up on the surface of the filters. The chemical reaction of the sorbent with the acid gas creates a solid particulate that is also captured on the filters alongside the unreacted sorbent and the process particulate.

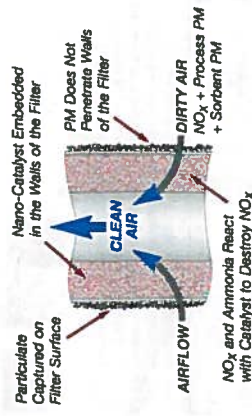
With sorbent injection, SO₂ removal is typically 90 percent or higher, with removal efficiencies as high as 97 percent. HCl removal is typically 95 percent, and often as high as 99 percent. The temperature range for effective removal is 300°F to 1200°F (see Figure 3).

Table 4

Ceramic filters are most effective where there is a large fraction of PM _{2.5} and submicron particulate			
Efficiency of fibrous ceramic filter elements in various applications			
Process	Particle size, µm	Inlet PM loading, mg/Nm ³	Inlet efficiency, %
Aluminum powder production	<50	550	<1
Nickel refining	<10	11,900	5.16
Smokeless fuel production	4.8	1,000	0.44
Zirconia production	1.2	8,000	3.5
Secondary aluminum	<1.0	870	0.38
Diameter of median size particle		0.5	0.0002
			>99.99

Sodium bicarbonate (baking soda) and trona are typical sodium-based sorbents. Trona is the naturally occurring ore from which soda ash and sodium bicarbonate are produced and is mined exclusively in Wyoming. When properly milled, trona can be used as a dry sorbent, no other processing required, and it is available throughout North America.

Figure 4 Ceramic fiber filter tube with embedded nano-catalysts



NO_x and dioxin control

For NO_x or dioxin removal, UltraCat catalyst filter elements are available with nanobeds of SCR catalyst embedded in the walls. The filter walls that contain the catalyst are about 3/4 inch (20 mm), as represented in Figure 4. Urea or ammonia is injected upstream of the filters. The catalyst embedded in the filters destroys NO_x with up to 95 percent removal efficiency.

Note the lower operating temperature required for high NO_x destruction: 350°F to 400°F, compared to 600°F to 650°F for conventional SCR. Besides the need for high temperature, a common problem with traditional SCR is the catalyst becomes poisoned and ineffective, necessitating early replacement. Typical poisons are ordinary PM, metals, and HCl. The catalyst used in the filters also has a proprietary formulation with a fraction of the conversion rate of SO₂ to SO₃ of traditional SCR catalysts.

The increased reactivity shown by the catalyst filters at lower temperatures results, in part, from their micronized form. The diffusion restriction is eliminated, and, most significantly, the catalyst is almost completely protected from blinding by particulate matter, since it is protected inside the filter fiber (see Figure 5). PM removal, sorbent injection for SO₂ (and other acid gases) and catalytic reduction can be incorporated in a single system.

It is important to note that operating temperature for high NO_x removal must be kept at 350°F to 700°F to achieve NO_x removal up to 95 percent.

Figure 5 Micrograph of nano-catalysts embedded in ceramic-coated fibers



Dioxins are also broken down by the catalyst. Optimum performance for dioxins is limited to an upper temperature of 480°F. Within a wide range, destruction efficiency is typically 97 to 99 percent.

Multi-pollutant capability creates a powerful, all-in-one solution that is superior, in both performance and economics to having a separate pollution control device for each pollutant. Especially with NO_x, in many circumstances there is insufficient temperature to operate traditional SCR. Low-temperature NO_x removal capability opens a new direction in NO_x control for operators of a wide range of boilers, and other industrial processes requiring NO_x control (see Figure 6).

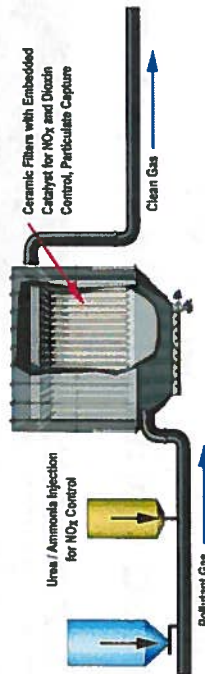
Mercury control

The ceramic filter systems are compatible with standard mercury removal techniques. Control of mercury is notoriously difficult; each instance is analyzed individually and customized solutions are engineered. A few general observations can be offered, however.

The filters can handle very high particulate loads while maintaining exceptionally low outlet levels. Just as the addition of dry sorbents for the removal of acid gases is effective, so is the addition of powdered activated carbon (PAC) for mercury. In general, regular PAC becomes less effective with temperature, dropping out around 400°F. Under the right conditions, 70 to 80 percent control can be achieved. The chemical composition of the pollutant gas plays a major role; hence, the difficulty of blanket statements. At higher temperatures, brominated PAC is required. According to the manufacturers of brominated products, temperatures of 500°F to 800°F are acceptable. Significant levels of mercury capture have also been achieved in applications with injected powdered trona.

When would ceramic filters be the control technology

Figure 6 Control of PM, SO₂, HCl, NO_x, and dioxins



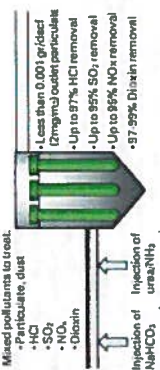
of choice?

For particulate removal only, the standard UltraTemp ceramic filter can operate at temperatures up to 1650°F. This is far above the temperature range of fabric bags. For applications with temperatures below 400°F that do not have temperature excursions or hot materials that pose a fire hazard to the bags (as can happen with biomass boilers), or other special circumstances, the fabric bags are less costly than ceramic filters and would be equipment of choice. In borderline cases, the ceramic filters have a much longer element life and often prove to be the most cost-effective solution.

In applications that require NO_x removal, since fabric bags and ESP cannot control NO_x, the UltraCat catalyst filters are preferable. Ceramic filters also replace electrostatic precipitators (ESPs) when there is a need for very low PM levels, especially on applications with significant portions of PM2.5 and submicron particulate. The filters can handle much higher inlet loadings, are not subject to the selective removal constraints of ESPs, have lower maintenance requirements and fewer corrosion issues, and are roughly equivalent (or lower) in energy usage. Because of the formation of filter cake on the filter surface (which provides more exposure to the acid gases), filter systems consume significantly less sorbent and higher removal efficiency can be achieved on acid gas removal. As stated, fabric bags and ESP do not remove NO_x or dioxins, of course, so a second device (perhaps with temperature addition which can be very expensive to operate) would be needed following them. This adds a layer of cost and complexity. In contrast, the UltraCat catalyst filter can handle all the pollutants in a single device at lower temperatures (see Figure 7).

Modular design of the housing units allows filters to be configured to

Figure 7 Catalytic element performance



The catalyst handles all the pollutants in a single device at lower temperatures

handle even large gas-flow volumes. When large flow volumes are treated, modules are put in parallel. The systems are designed so that a single module can be taken off line if required, and the remaining two or more modules continue to operate at a slightly higher pressure (designed into the fan) without interruption of process itself and with no appreciable change in emission control performance (see Figure 8).

Lightweight ceramic filters have been used for the last 10 years by the U.S. military at munitions-destruction facilities in Indiana, Utah, and Oklahoma. There are hundreds of operating ceramic filter applications throughout the world. With a rapidly growing commercial base in the U.S., the UltraTemp and UltraCat filter systems provide a way to master many of the difficult situations faced by owners, operators, and consultants in meeting the increasingly strict regulations regarding air pollution control.



Figure 8 Multiple modules are operated in parallel to handle large volumetric flow rates. With 3 or more modules, if a module needs to be serviced the other modules are designed to temporarily operate at higher pressure with minimal change in performance

Primary Applications

Boiler MACT compliance for coal, biomass, wood
Glass furnaces
Waste incineration
Waste pyrolysis
Metal smelting, mineral processing
Chemical production
Many specialized high temperature applications

More Applications

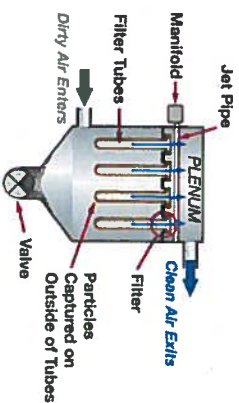
Air Pollution Control
Cement production
Medical waste
Soil cleaning
Foundry processes
Fluidized beds
Energy production
Fire testing
Product Collection/Recovery
Titanium dioxide production
Furned silica production
Carbon black production
Catalyst manufacturing
Platinum smelting
Metal powder production
Activated carbon production

Operation of the UltraTemp filtration system

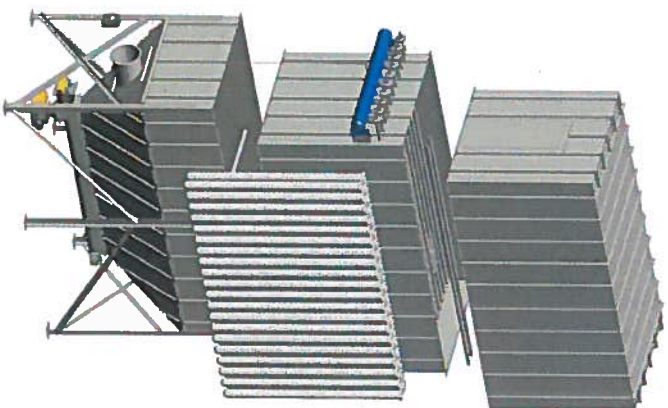
Tri-Mer's UltraTemp and UltraCat Hot Gas Filter systems use baghouse configurations with a reverse pulse-jet cleaning action. The filters are back-flushed with air, inert gas, or other appropriate gases. A reliable sealing mechanism is easy to access, and the design has been engineered for easy installation and maintenance. Filter elements are manufactured in various sizes, the largest of which is ten feet long and six inches in diameter, including an integral mounting flange.

- Pressure drop across the system is approximately 6-8 inches w.g. - lower than the total energy usage of multi-step systems.

Operation of Filters



The UltraTemp and UltraCat Filter systems are efficient, cost-effective approaches for hot gas filtration. With over 400 applications worldwide that use the fibrous ceramic filter elements, this proven technology is now commercially available throughout the US, with full technical and start-up support.



Housing modules are manufactured at the Tri-Mer factory in Michigan and sized for convenient shipping. In the field the sections are lifted by crane and bolted together. Filters are then installed by Tri-Mer personnel. The top section is a walk-in plenum for easy, clean maintenance access in all weather; middle section is filters; bottom section is the collection hopper with internal screw conveyor to rotary or slide gate valve discharge.

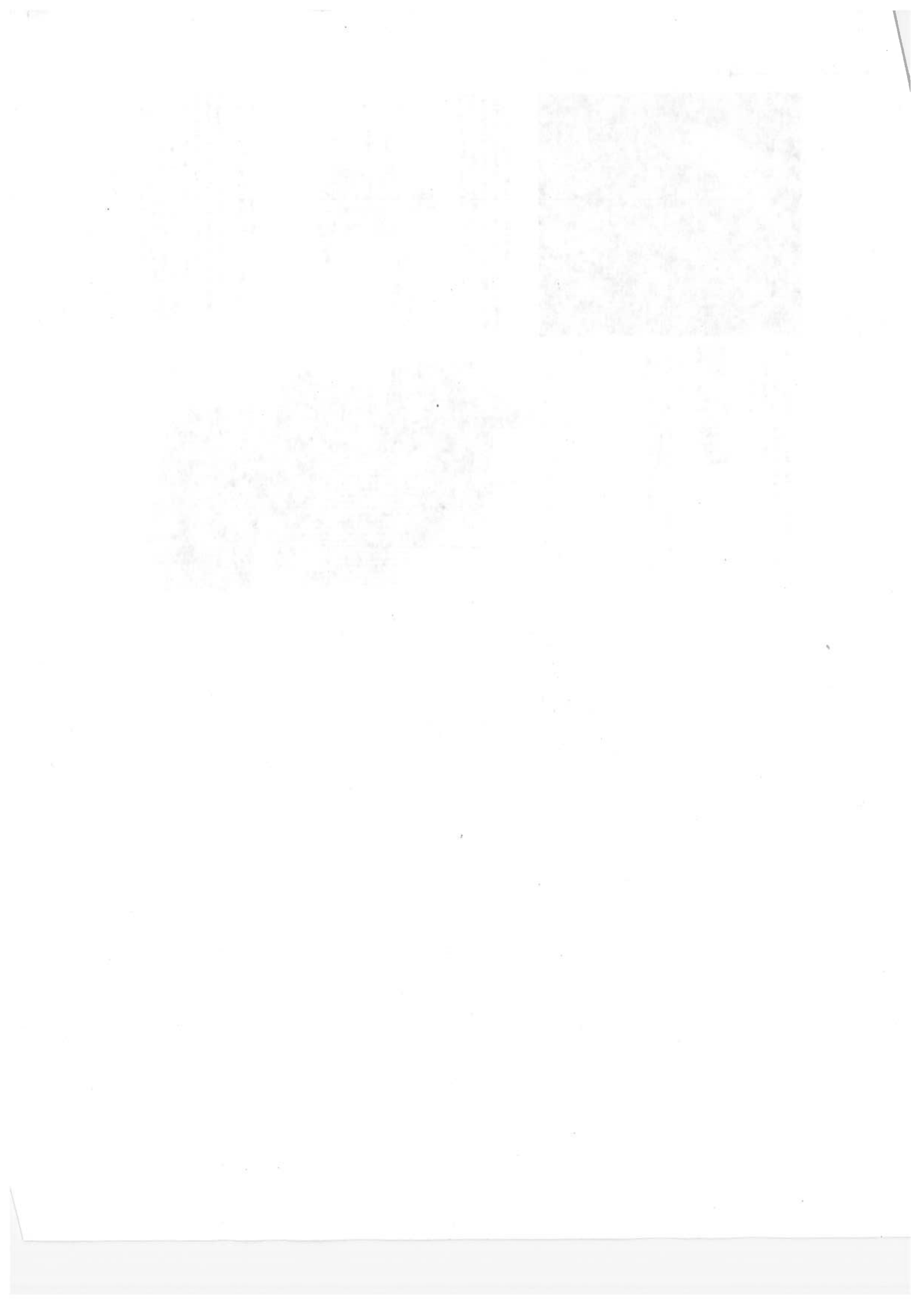
Tri-Mer Corporation, a technology leader in air pollution control, provides turnkey engineering, manufacturing, installation, and service for the UltraTemp and UltraCat filter systems through its Michigan factory headquarters.



Technology Leader
air pollution control

For more information, contact Kevin Moss,
Tri-Mer Business Development Director, Advanced Technologies,
Direct line: (801) 294-5422, or kevin.moss@tri-mer.com





ST&J/ygt

17K

78-A-023 S7

Biomass (wood chips) Boiler Permit
Boiler MACT
new wet stoker " sampling
Fuel sampling 1/run
UOx, PM, VOC
start date
Filter like BH
relyse Trimer Filter
CR (Urea) → NOx
not dried

MARK Maxwell

319-335 6185

335 6266

335 4028

Address
2304 Crosspark Road
Coralville, IA

Location of

Lisa Hawton 7599

Steve Kottenstette

OAKDALE Renewable Energy

27 mmBtu/hr

Ind 15 m

limit in Table

New: New facility under Boiler MACT

Wenegaunee to burn Landfill

Immediate testing wet Biomass filter limits

Trimer Filter (Baghouse)

Ceramic cartridges 4x1.5
catalyst IMPROVED
SCR like

Harold Baker
816 584 569

Directions:

Go to Coralville 5-6 hrs

I 35 to I 80 2100 mile past 218

Hwy 965 (Bigma)
North on 965 (mile)
TO Oakdale Blvd

Right on OAKDALE BLVD

1/4 mile Crosspark Road to Plant

11/31/13 FR

40 CFR Part 63 Subpart DDDDD Table 1 217.00
We Test for HCl, Hg,
wet Bio. Filter, MS PM

7E
3A
10
30B
26

ext DeWitt R(s) to Jefferson St R

Iceberg visit Merado McMurdo

Madison St (1/2011) DAILY 150'
USB

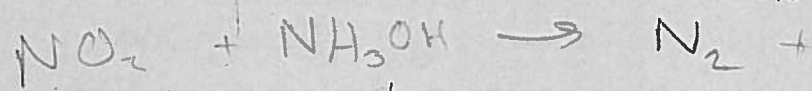
Arrival 7:30
Jan

23 Jim Robertson crawled

Dan Tui der

TE107 30521 202
Abe Dickinson

- Facility
- Joe Schurbrash
 - Matthias Miller mg
 - Mike Dooley 303
 - Horst R. Richeen



- water in sample lines
- APCO pollen 60-140 ppm NO_x (MAX 22K #/hr)

26/5/202 2E, 3A on 7/23

15,000 #/hr 4.13 ± #/hr

11-12 K#/hr, 1.2" ΔP H₂O, 11.3" ΔP H₂O

35 Boiler Demand speed of screws for wood drive 50% MAX
ID Fan MAXed @ 100% on Drive Down of 15H

U. I. C. 1 PM 5/20/2

Primer

ASSISTANT DIRECTOR

B&N FIRST

Will Syngas be burned during test?
Combined Stack

U. I. C.

Steve Koltonskette

319 335 6185

MARK MAXWELL

Master's List

Jim Robertson

Rich Sollars

Brandon Schuler

Abe Dickinson

MARK

319 631-1950

U. I. C.